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The Geographical Journal

INCLUDING THE PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY.

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For Notices as to the Society's Meetings and other important matters, see p. iv.

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Extra Publications.—'The Pamirs and the Source of the Oxus.' By the Right Hon. George N. Curzon, M.P. 83 pp., royal 8vo, with many Illustrations and large new Map of the Pamirs. Price, bound in half-calf, to non-Fellows, 6*s.* nett; to Fellows, 3*s.*—'The Topography of the Battle of Platæa.' By G. B. Grundy, B.A. Price, bound in half-calf, to non-Fellows, 5*s.*; to Fellows, 2*s.* 6*d.*—'Notes on the Kuril Islands.' By Captain H. J. Snow. 8vo. 88 pp., with two large Charts, revised by Captain Snow. Price, in boards, to non-Fellows, 4*s.* nett; to Fellows, 2*s.*—'Eastern Persian Irak.' By General A. Houtum-Schindler. 8vo. 132 pp., with Map. Price, to Fellows, in boards, 2*s.*; bound in half-calf, 3*s.* 6*d.*; to non-Fellows, in boards, 3*s.* 6*d.*; in half-calf, 5*s.* nett.—'A Journey on the Upper Mekong, Siam.' By H. Warington Smyth. Sixty illustrations and three maps. Price, bound in half-calf, to Fellows, 4*s.*; to non-Fellows, 7*s.* 6*d.* 'British New Guinea: Country and People.' By Sir William Macgregor, K.C.M.G., C.B. Map and Illustrations. 100 pp., 8vo. Price, in boards, to non-Fellows, 4*s.* nett.; to Fellows, 2*s.* 'Supplement to the Bibliography of Algeria, from the earliest time to 1895.' By Sir Lambert Playfair, K.C.M.G. Price to Fellows, 2*s.* 6*d.*; to non-Fellows, 5*s.* Historical Atlas of the Chinese Empire. By E. L. Oxenham. Price to Fellows, 17*s.* 6*d.*; to non-Fellows, 30*s.*

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General Index to the fourteen volumes of the *Proceedings R.G.S.*, New Series. One volume, Royal 8vo. 250 pp., double columns. Price, to Fellows, 2*s.*; to non-Fellows, 5*s.* Only a few copies now remain.

Evening Meetings in May.—Monday, May 8. Explorations in the Bolivian Andes. By Sir Martin Conway. **Monday, May 29.** Explorations in Patagonia and the Eastern Andes. By Dr. Francisco Moreno.

The Annual Dinner and Conversazione.—The Annual Dinner of the Society will be held on the evening of the Anniversary Meeting, Monday, June 5, in the Whitehall Rooms of the Hotel Metropole, at 7 for 7.30 p.m. Application should be made for tickets (21*s.* each) before May 29 to the Chief Clerk, 1, Savile Row. Fellows may bring guests. The Society's Conversazione will, by permission of the Trustees, be held in the British Museum of Natural History, South Kensington, on the evening of Wednesday, June 7. Special circulars will be sent to Fellows.

Any Fellow resident in this country, desiring to have notice of the subjects of papers to be read at the Society's Meetings forwarded to him, can receive such notices by post on payment in advance to the Chief Clerk, at 1, Savile Row, of 2*s.* per session.

The Society's House will remain open for the Convenience of Fellows on the evenings of the Society's ordinary meetings till 8.15.

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* See also pp. vi. and viii.

The
Geographical Journal.

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THE USE OF PRACTICAL GEOGRAPHY ILLUSTRATED BY RECENT FRONTIER OPERATIONS.*

By Colonel Sir THOMAS HOLDICH, K.C.I.E., C.B., R.E.

All good geographers will rejoice in the fact that a school of geography is likely to be started at the University of Oxford, the first school of its sort that has ever been inaugurated in England. And, if we think of the vast interests that England owns in the wide world of geography, her colonies, her conquests, and her commerce, it seems strange indeed that, in recognizing the necessity for the inclusion of geography in her wide curriculum of university teaching, she should have waited on the initiative of other countries, whose interests are but the shadow of her own. But university teaching, immensely valuable as it cannot fail to be, can hardly extend beyond the academic stage. The processes of geographical evolution in all their many branches, the intimate relation of geography to history, to archæology, to geology, together with something, perhaps, of the rudiments of those methods by which geographical facts are represented (*i.e.* cartography), all these things may be taught effectually in such a school, but into the regions of the hard practical attainment of geographical knowledge it can hardly enter. It is this practical phase of the subject that I wish to introduce to your notice to-night, and to show you, if I can, of what immense importance it is to our national business, whether commercial, military, or political.

A knowledge of geography most intimately affects matters naval and military. On this point there is no division of opinion now, whatever there may have been formerly. And because the importance of this knowledge is so fully recognized by our sailors and our soldiers, I need not

* Read at the Royal Geographical Society, March 13, 1899.

enlarge on it, even if there were time to do so. No military or naval force of any importance ever takes the field in these days without being fully equipped with all the means for acquiring geographical information, whether in the aggregate for strategical purposes, or in detail for minor tactical operations. And if a project is afoot for investigating the remoter problems of ocean geography, nine times out of ten that project will be initiated by a sailor and be supported by the navy. The roll of our military and naval explorers is a long one, and a splendid one; so that it was, perhaps, not altogether inappropriate that the Geographical Society's delegation to Oxford to arrange the preliminaries for the new school should have included representatives both of the navy and the army.

But when we turn to the civil, particularly the commercial, side of the question, it is still a surprise to me that the value of full geographical knowledge has not been more widely recognized. It would not be difficult to adduce instances in which thousands, not to say millions, of pounds have been misspent for the want of that preliminary information which only complete mapping can give. We will suppose that a railway scheme is projected in a comparatively unknown sphere. The first and obvious means of estimating its chance of success is to examine existing trade routes, and to count up the amount of traffic that passes along them. This is all very well, and, indeed, it is necessary; but it is often forgotten that there are radical points of difference in those conditions of land conformation which govern railway construction, and those which govern a trade route. The one sacrifices grade to distance, and is content to climb over mountains, so long as climbing mountains affords the most direct way to its object; the other sacrifices distance to grade, and would much prefer to crawl round the mountains, so that the gradients are easy. And thus it happens (I could quote a very remarkable instance) that one or two alternative routes are traversed and examined and estimates are made for expenditure in railway construction, and that vast sums are finally expended over a difficult alignment, when a fair and square geographical survey, covering a wide area, would have revealed a far easier, less expensive, and possibly even a more productive route, following a line that was never even dreamt of. This is the sphere of practical commercial geography, and in the business of the world it covers a far wider field than the mere alignment of railways. This phase of the subject is, however, scarcely less comprehensive than that of military requirements, and it is impossible to follow it further in the short space of time that is at our disposal.

It is, perhaps, in those international negotiations and agreements which concern the political status of great countries, and determine their boundaries and the respective limits of their responsibilities, that the danger of inaccurate geographical knowledge is greatest, and the results of it are the most disastrous. Truly this period in our history has

been well defined as the boundary-making era. Whether we turn to Europe, Asia, Africa, or America, such an endless vista of political geography arises before us, such a vast area of new land and sea to be explored and developed; such a vision of great burdens for the white man to take up in far-off regions, dim and indefinite as yet; that it can surely be only by the grace of Providence that we shall finally emerge from the struggle to rearrange the world's partitioning, without some deadly contest with others whose interests in these new arrangements are hardly less than our own. And I may, perhaps, be permitted to say, that just as the Providence of battles usually favours the biggest battalions, so it is likely that the widest geographical knowledge will prove the best safeguard against misunderstandings, and will at once dispose of such false estimates of the value of portions of the world's surface here and there as have occasionally brought England perilously close to the dividing-line between peace and war. By geographical knowledge I do not mean simply that knowledge of the Earth's surface which we gain by surveying it. I mean also a knowledge of those ordinary laws of nature which decide the configuration of mountains and the flow of rivers, where certain influences must inevitably lead to certain conditions. I mean, also, such knowledge of the technical application of geographical terms as will prevent misunderstanding about the meaning of words and phrases.

Of all sources of international irritation, boundaries seem to be the most prolific; and of all countries in the world England has probably suffered most from them. To refer to modern history only, it was the Sistan arbitration which first turned Sher Ali's heart against us, and originated the Afghan war of 1879–80; it was a boundary which brought England and Russia face to face in Turkestan in 1884, and so nearly forced us into war; it was a boundary (nothing less) that started Umra Khan on his quest for Chitral; it was a boundary which set all the north-west frontier in a blaze lately. And yet all this boundary-making has been in the interests of peace alone. The want of these boundaries would more surely have led to wider-spread, more disastrous war than the making of them, and it seems of all things most extraordinary that efforts honestly made in the interests of peace and good government should not be possible, without bringing great countries to the verge of blows.

Well, in my opinion it is very much more possible than our recent experiences would seem to prove, and it is my belief, looking back over the boundary episodes of the last twenty years, that the greater part of the political difficulties which have arisen in connection with boundary demarcation have been due to a want of appreciation of the necessity for a sound geographical basis to the text of treaties and agreements. Misunderstandings, delays, expense, and mutual international mistrust

have over and over again arisen from quite insignificant causes connected with inattention to exactness in geographical definitions, if not with actual geographical ignorance. When a man makes a will, he is careful that his intentions should be expressed in language which is at least technically accurate, if not always intelligible to ordinary understanding. Such safeguards are not always adopted by statesmen in drawing up the terms of international agreements, and the result is that the actual geographical facts of nature will not always tally with the agreements. If I give a few examples to illustrate my meaning, please understand that they are not altogether hypothetical cases, but that I am referring to actual occurrences where either want of definition, inexact definition, or positive geographical ignorance, has led to complications so awkward as to have involved, not only delay and its attendant expense, but political misunderstandings and irritation, which has not, in some cases, disappeared to this day.

If we take such an ordinary expression as "the foot of the hills," for instance. What is the meaning of the term? Most people would be prepared to explain it offhand, but a little consideration will show that it is capable of various interpretations. Where a mountain mass shelves down in precipitous slopes, ending with a rushing torrent at the foot, there can be no mistake; when you arrive at the torrent you are certainly at the foot of the mountains. But when these more or less precipitous slopes end in shelving spurs, gradually tailing off into long sweeps of upland, gently sloping downward and away to a placid river flowing in the midst of a valley, where is the foot of the hills then? Is it where the steep gradients cease, and you step off the rising mass of craggy hillside to the gentle declivities of grassy slopes, trending away to cultivation and villages and orchards? or is it where you come to the river-banks in the midst of the valley? The decision in this case led to most awkward misunderstandings with Afghanistan. Take another case. "In an easterly direction." What is an easterly direction? Is it as nearly due east as it can be made? or is it a little east of north, or a little east of south; anywhere, in fact, except either westerly, or due north, or due south? This was a question which had to be decided on the Pamir boundary, and it was decided at last in the latter sense rather than the former. These are cases of want of definition. As for inexact definition, *i.e.* the use of geographical terms in either too limited or too extended a sense, other great countries besides England have suffered to an extent that is absolutely incalculable from their use. Every one knows that there is nothing like a good strong natural feature as a state boundary—something which every man can recognize from afar, and which he cannot mistake if he encounters it. Such features are found in rivers, and in water-divides, and they have been impressed into the service of international boundaries all the world over. But they cannot always be utilized, and

then recourse must be had to artificial demarcations, which are good enough when they take the form of the great wall of China, but which can be made productive of endless mischief when they are adopted lines of latitude or longitude, or any other form of line which has to be marked out by artificial and perishable erections. Under certain conditions rivers are good; under others (as, for instance, when they change their course, and their channels absorb valuable ground, or throw up unexpected islands in a highly cultivated country) they are bad. The channel of a river under these circumstances is a most undesirable boundary. Watersheds, or water-partings, are the best of all possible natural boundaries, for they are liable to no change, and are readily recognizable. But even great central watersheds must be treated with

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care, and the bigger and more unmistakable they are, the more care do they require. To take a hypothetical example. Supposing it were a matter of determining a boundary between India and Tibet. Standing back some 100 miles from the plains of India, in the centre of the Himalayan mountains, is a magnificent central watershed (or water-parting), which stretches from Kashmir to northern Assam. The greatest snow-peaks and glaciers of the world are piled on to the summits of this vast crystalline axis of the Himalaya. Could anything be better than this magnificent array of unapproachable snow and ice to serve as the unmistakable barrier between two vast Asiatic countries? Nothing could be better, provided we do not define it as the watershed between India and Tibet. From its southern flanks the first beginnings of many mighty rivers flow southward to the plains of India; from its northern

buttresses and spurs many a torrent pours northward—and turns equally to the plains of India. The Indus and the Brahmaputra drain the northern slopes of the central Himalaya, enclosing the great mountain system between them, whilst the largest affluent of the Ganges cuts it right in two.

What is true of the Himalaya is true of nearly all the great mountain systems in the world, *i.e.* the watershed of the system is beyond, and apart from, the highest mountain chain. This is true also, in a smaller sense, of smaller ranges—so as to make it essentially necessary to distinguish between a central chain of peaks and the water-divide of the system as a whole. One other example of incorrect definition will perhaps appeal to you more directly, for you will know where its application comes in if you remember the disputes which arose about the Oxus. The source of a river is sometimes adopted as a definite geographical point in a boundary agreement, regardless of the fact that every great river in the world must have several sources. To indicate that the source intended is to be the source of the principal affluent, is merely to invite a storm of dispute. How are we to reckon up the principal affluent? Is it the longest, or the widest, or the one which carries most water? Does it not occur to you that the solution of such a problem is almost hopeless. And what, after all, is the source of a stream? for it is the streamlet that we finally get to. In some few cases it may be a definite spring; in many cases it is an indefinite glacier; in hardly any case can it possibly be a lake. Lakes are, as a rule, but incidents in the course of a stream or river—a widening and deepening of the river-bed which permits of the collection of water. There are doubtless lakes that have no streams running into them, but which are fed by subaqueous springs. But they are not usual, and the existence of such springs is not easily ascertained.

But I will pass on to the more serious matter of positive geographical ignorance, *i.e.* the inclusion of topographical features by name which either do not exist at all, or which may exist in too great a quantity. As to the latter, I could remind you of the hopeless confusion which arose during the delimitation of the boundary between Kafiristan and Chitral, owing to the fact that two separate and important rivers of the same name were found in the same region. The danger of too free a use of place-names could hardly have been more forcibly illustrated, for it led to an absolutely new alignment of an international boundary, and a new phase of political responsibility. As to the former, I may be permitted to refer for once to a specific instance, because I shall be dealing with what is now ancient history, and the example is too apropos to be overlooked. In the year 1884, a mission started from India to fix the boundary between Afghanistan and Russia. The amount of boundary actually to be found and demarcated was inconsiderable—about 300 miles—and the field of operations, though rough, remote, and inhospitable (especially in winter)

was well enough adapted for geographical surveying. It was almost unknown before the mission started, but still maps of some sort had to be accepted as the basis for agreement, and on one of them was found an apparently suitable point on the Oxus for assisting the process of boundary definition, called Khwaja Salah. There were eight or ten political officers on that mission, besides a large native political staff. Fifteen hundred men and fifteen hundred animals started from India alone, and they met another large contingent from Europe. You will remember that the work of the mission did not progress rapidly, and that it was two years ere it returned to India with that work only partially accomplished. The expense of it, and the suspense of it—the bitterness and hostility that were aroused, are matters that I do not wish to refer to further than to say that they were accentuated by delay, and that delay was largely increased by the necessity for hunting for the post of Khwaja Salah. We never found it. There was a district of the name, and a ziarat, but no "post" such as was described. I need hardly say that opinions differed even within the limits of our own camp, nor remind you that there was another camp which also held most decided views of its own. The question was never settled, the post of Khwaja Salah was never found, and I am now free to express my own opinion that it had been washed into the bed of the Oxus so many years ago, that nobody could exactly remember when the accident happened. That is a specific instance, but, as a matter of fact, the work of that mission was one unceasing hunt for a possible boundary within impossible limits, because those limits were laid down on a basis of what can only be called geographical ignorance. For there *are* impossibilities in demarcation. On another and later occasion, a boundary was defined as running parallel to a river at a distance of 4 miles from it. This 4 miles carried us into an indefinite region neither at the top of a mountain range nor the bottom of it, but hanging as it were in mid-air, surrounded by such a vast chaos of crags, spurs, and precipitous cliffs, that no one could possibly have demarcated a yard of boundary in such a position.

One last hypothesis I will venture to suggest as a close to this part of the subject, and I suggest it with all deference. Seeing that final political action has, after all, to wait on the evolution of geography, or, in other words, that no final agreement can be come to without the preliminary evidence of completed maps; and that such agreement is seldom effected in the actual field, but usually by the high contracting parties of either government acting in concert at home; would it not be better to save the delays, and the expense, and the chance of arousing bitter feelings of animosity, by obtaining this preliminary geographical information first (without raising one single political argument), and settling the matter on geographical evidence afterwards? Now, it seems to me that a full knowledge of the *use* of geography must inevitably lead up to this conclusion. In support of it, I may adduce yet one more instance.

About the same length of boundary (*i.e.* 300 miles) had to be settled and demarcated in another country, equally rough, more inhospitable, almost as remote; and the business lay with people as changeable and difficult to deal with as any in the East. But in this instance the maps were ready, and there was little or no room for discussion, and no opportunity was allowed for hatching new objections. In a month, or a little more than a month, that boundary was all settled, and it was settled just in time. Clouds had arisen on the horizon even in that short space, and within a month of its completion a storm had burst which would have shaken an incomplete agreement all to pieces.

So much, then, for the advantages of accurate geographical knowledge to state purposes. We will now consider, as far as space permits, how to get that knowledge, for this is perhaps the most practical business of all.

Assuming, then, that in all the great practical business of life, whether military, commercial, or political, which is based on geographical fact, it is admitted that accurate geographical knowledge is so great a preliminary advantage, that no effort should be spared to attain it, I have something to say about the methods which should be employed in order to attain it. It is easy to say, "Let us have accurate maps, by the light of which we may form our opinions and settle our differences," but it is not always so easy to get them. It is, however, very much easier than is generally supposed, and I speak from experience when I say that in matters commercial or political it is the shortest, as well as the cheapest, way to the desired end. I am not going to inflict on you any technical details. I only wish to draw a sharp distinction between accurate geography, and the geography of the traveller or prospector who is content with what falls under his immediate observation in certain limited areas. We want, for public business purposes, in the rapidly developing lands of the future very much more than that; we want sound, square, geographical maps, of which the topography is equally balanced in value over all the map, and in which the whole mapping is based on systematic measurement, the correctness of which can be proved. The only way I know of to attain such mapping is to triangulate first, and to complete the topographical details on the basis of the triangulation. This is all the technical information I need trouble you with, but this much is of infinite importance; it is worth remembering; and the principles of it should be inculcated in every geographical school that exists. The advantage of triangulation is this. In the first place, you cover the country with a scattering of fixed points, which are the guiding signs and landmarks for all subsequent operations whatsoever. So long as two or three such points are visible, no one can ever again complain of difficulty in discovering his exact position on the world's surface. In the second place, you establish a double record. There is the geographical record of the completed map, and there is the mathematical

record of the computations which establishes its correctness. Two people may represent the same country in totally different ways, and each claim superior accuracy. So far as the maps go, it is impossible to decide between them; and it might be necessary to travel far and spend much time in ascertaining their relative correctness. This cannot occur if the country is triangulated. Observations may indeed go astray, but the resulting computations at once prove their weakness—at once show which are right and which wrong, and establish a final record which admits of no argument, and from which there is no escape. Every point on a boundary-line, every peak in a mountain system, every landmark of any importance in the country-side, has a value whose correctness can be proved just as easily in a London office as in the open field. And

LAKE VICTORIA.

this value is not only incontrovertible, but absolutely distinctive, because every point on the whole world's surface has its own special position in terms of latitude and longitude, with which no other point can interfere. There is no necessity for inexact geographical definitions, no calling of places by their wrong names, no chance of confusion or possibility of future discussion, so long as a point is defined by its co-ordinate position in latitude and longitude. I cannot follow this subject further, though there is much more to be said. I can only add that, in my opinion, a survey without a mathematical basis is no survey at all.

The one objection most frequently raised to this geographical system of mapping (which we may fairly call the Indian system) is that it is so difficult; that there are large areas of country which it would be impossible to triangulate; and that, at best, it takes time. Its difficulties are very much exaggerated in these days, when such splendid instruments

are available; and as for the time it takes, we have found that we can easily hold our own against any other system that is worth calling a system at all, and that even under the pressure of moving forward by daily marches at a rapid rate through open country, triangulation can generally be maintained. But it doubtless requires room to see around, and I admit that in the dim twilight forests of Africa, for instance, it might be necessary to resort to more elementary methods of measuring distances. I have never seen any impossible country; the jungles and forest-clad plains of India and Ceylon have all been triangulated, and the highlands and plateaus of Persia, Baluchistan, Afghanistan, Turkistan, or the Pamirs, are all open country. But there are doubtless circumstances under which triangulation may be exceedingly difficult, if not impossible, and it is with an illustration or two of such exceptional conditions that I will conclude my paper.

In the long narrow ice-bound valleys which lead up from the Hindu Kush to the Pamirs, where one can only see, towering thousands of feet above, the lower knobs and buttresses of gigantic spurs which intersect the glaciers of the mighty ranges on either hand—where the wind whistles down with the force of steam and the temperature of ice; we were once, to use a familiar term, fairly bunkered. We had got our triangulation up so far without the assistance of a day's halt even, and now came the difficulty. We couldn't climb out of it; we could only work along with short bases and long narrow intersections. We had to stick to it, for triangulation was important. For aught we knew, the Russian surveyors would have their triangulation to support their contentions, and if they had and we had not, we should have been at a scientific disadvantage. Moreover, the question of latitude was an important one. Much depended on the latitude of Lake Victoria, and although under ordinary circumstances latitude values can be obtained with all necessary precision by astronomical observations, it was not at all a certainty that they could be so obtained on the Pamirs. Where masses of mountains exist, there is, unfortunately, a liability to error introduced which cannot be readily calculated, and the amount of such error may be very large indeed. We laboured on as best we could, but it is an open question whether triangulation under such conditions would have proved satisfactory, or beyond challenge, when we were suddenly relieved of all our difficulties. One glorious day, when the mist-wreaths had disappeared from the snow-capped peaks, and rivulets had become rushing torrents, Colonel Wahab climbed up an exceedingly high mountain (we surveyors think 19,000 feet a very fair climb), and across the back of the distant Hindu Kush he saw the line of Kashmir peaks, fixed by Tanner in former years, pointing the way to direct connection with Indian triangulation, and at once providing us with exact conclusions for the basis of our work on the Pamirs. These peaks were seen again on subsequent occasions. Three days only were lost in

attaining exact results, and they were three very well expended days, for thereafter we were, in a scientific sense, masters of the situation, and our junction with Russian surveys in Trans-Caspia was a complete success. The point of this story lies chiefly in this, that we were helped out of our difficulties by the prevision—or provision, I might call it—of another surveyor, Colonel Tanner, whose own geographical surveys were widely apart from ours. It was the unforeseen value of his triangulation that points the moral of this tale.

Once again we were in difficulties. We were in the lower Chitral valley during that uneasy time when all the frontier was ablaze; we were, in fact, outside Chitral at the time when some of our friends, to whom we had looked for assistance in demarcating the

PILLAR NO. 1, AT EAST END OF LAKE VICTORIA, ON WHICH THE RUSSIAN AND ENGLISH SURVEYS CLOSED TO A CONNECTION.

boundary between Chitral and Afghanistan, were inside, and couldn't get out. When we first appeared in the Kunar valley as guests of the Amir's commander-in-chief, Ghulám Haidar, a very pretty fight had just been raging between him and Umra Khan of Bajaor. Between us and Chitral, in fact, Umra Khan had possessed himself of the valley along which it was our business to survey, and he barred our way. Whether he guessed that boundary demarcation would turn him out of that valley, I cannot say, but instead of coming into our camp to represent his own claims, he started on the warpath for Chitral. A curious change came immediately over the spirit of that frontier drama. Across the hills separating our valley from Bajaor, the genial giant Ghulám Haidar metaphorically stretched out the hand of

friendship to Umra Khan, and in a spirit of almost Christian forgiveness the latter helped himself from that Afghan army which was our protection to assist his progress to Chitral. He even suggested that, should he not meet with all that success which he undoubtedly deserved, he would send his wife and family for protection to our camp. We already had the Chitral refugees—relations of the lately murdered Mehtar—so our company promised to be mixed. Inside Chitral our friends were having a worse time than we thought, for we had comforted ourselves with the reflection that four hundred Sikhs and two guns were more than a match, inside good defences, for as many Chitral bandits or Pathan deserters as might array themselves against them.

Anyhow, the circumstances were not promising for triangulating the Chitral valley. Triangulation, indeed, was impossible. Once again, however, we were helped out of our difficulties by the prevision of a past race of surveyors. We knew that if we could only gain the mountains of Kafirstan overlooking Chitral, we should sight the great peaks long ago fixed by Carter (now Colonel Carter Campbell) from the neighbourhood of the Indus, and our difficulties would be ended.

Something had to be done, or we should determine no boundary at all. So we persuaded Ghulám Haidar to give us an escort of five hundred of his trusty warriors for an expedition into the land of the Kafirs. Never shall I forget that fortnight's trip into the Kafir highlands. It was the time when the wild almond blossoms covered the steep hillsides down to the river's brink, when lilies and violets and strange forms of honeysuckle were brought to decorate our tents; a time of spring sunshine that preceded that time of bitter winter snow which blocked the way for Kelly's force between Gilgit and Chitral. We wandered through thickets of wild fig and olive, under craggy cliffs covered with ivy—where the wild vine held together the crumbling rocks, under the shade of deodars, and up into forests of oak, the like of which I have never seen elsewhere. The acorns were treble the size of any ordinary English acorns, and I am pleased to think that a young tree sprung from one of them is now growing up at Simla. Beyond the forests we struck into the snow-bound hilltops, and finally we reached a point where a gigantic mass of craggy outcrop marked an unmistakable feature in the mountain landscape.

Here the situation was striking enough. All around us were the snowy mountains of Kafirstan and the Peshawur frontier, an apparently dead level of white undulations, broken only by the dark lines of jagged and splintered outcrop, but dominated here and there by those higher summits which had been fixed from afar by Indian triangulation. Almost at our feet was the black valley of Chitral, where our friends were fighting for their existence, and stretching away northward was the long sinuous line of dividing watershed which was to carry the boundary from the Hindu Kush to the neighbourhood of our camp on the

Kunar river. It was all spread out as in a map. There was no further difficulty in completing the necessary topography, and a few days' work secured the success of the expedition. Then we came down again, and I wish I had time to tell you of the manœuvres of our Afghan escort through the snow, which was sometimes up to their necks. Without transport, or commissariat, or medical arrangements, or tents of any sort or kind, five hundred Afghan soldiers followed us up those mountains, and followed us down again, guarding us closely, for there was no telling what the Kafir might not take it into his head to do. Not a man was the worse for it, as far as I know.

Here again I wish to impress on you that but for the prescience of our departed chief, General Walker, who possibly foresaw that geographical triangulation might well prove to be of paramount importance even in the future interests of frontier policy, and who started Captain Carter on that series of difficult operations from the Indus which ended in giving us help at an urgent hour of need, the Indian Government would certainly have had no fixed frontier at that time, and might possibly have been waiting for it even now.

And so I end as I began. The academic study of geography in its relation to ancient history, to archæology, to anthropology or geology, is of infinite use in assisting to solve the problems presented by these sciences, and the first establishment of a school at the university which will facilitate and encourage this study marks an epoch in the progress of geographical knowledge on which we may well congratulate ourselves.

But it is not quite all that is required. Something of the theory and the results of its practical application to the business of life, to commercial business, and to political business, is also wanted. Our soldiers and our sailors know how to make geography, and how to make use of it. I sometimes think that our merchants and our statesmen would make better use of it if they knew also how to make it, and if they fully appreciated the absolutely immeasurable cost of geographical ignorance.

Before the reading of the paper, the PRESIDENT said: This is not the first time that a meeting of this Society has had the pleasure of Sir Thomas Holdich's company, and I am quite sure we shall have as interesting a paper as we had last time he addressed one of our meetings. There is likely to be, I hope, considerable discussion of the paper afterwards, and therefore I will not detain you longer.

After the reading of the paper, the following discussion took place:—

General Sir PETER LUMSDEN: I congratulate the Royal Geographical Society on having secured such a practical master of his subject as my old friend Sir Thomas Holdich, who has so ably expounded the political, commercial, and economical necessity to this country of geographical educational development. I will not soar with my friend to the watershed of the Himalayas, or the Hindu Kush; nor will I descend these vast slopes to seek for his frontier along the foot of the hills; nor will I grope in the depths of the Oxus to seek for that geographical point, that will-o'-the-wisp, the Ziarut of Khwaja Salah, which he assured us was ages ago

swept away by the river. We need not go to the steppes of the Pamirs or the sources of the Nile to corroborate the stern facts which Sir Thomas Holdich has placed before us this evening, to illustrate the necessity of increased geographical education in this country; these facts are known to us, and they are so numerous that it would be out of the question to attempt categorically to enter upon them. I will only adduce one example in this country from my own experience, which caused a great deal of misunderstanding, and no small amount of correspondence. It was with regard to the practice prevalent amongst Scottish lawyers and factors of using the expression "skyline" as denoting the crest of the ridge or hill dividing two properties. However happy the expression "skyline" may be, and definite with regard to its nautical application to the sea-horizon, I think we ought to keep it at sea and not bring it ashore, where it is certainly perfectly indefinite and unintelligible, for I think it stands to reason that a "skyline" of that description must depend on the position of the observer, as it increases or decreases according as we approach or go away from the crest of the hill. I am content, and I dare say a good many in this room are equally so, to accept the testimony given by such a distinguished engineer, explorer, and competent surveyor as Sir Thomas Holdich, who for the past score of years has had unexampled experience in all matters connected with delimitation of national frontiers, and has so forcibly placed before us the knowledge he has gained in these operations. I trust that the Council of the Royal Geographical Society will be able to use its influence with the Government and people of this country, to secure for this national want of geographical education something of the same response which another Engineer officer so lately procured for education in the Sudan.

Lieut.-Colonel LEVERSON: I thoroughly agree with all Sir Thomas Holdich has said with reference to the importance of geographical knowledge in the determination of international boundaries. Maps, even if more or less accurate, are not alone sufficient. In order that full advantage may be taken of them, they must be supplemented by an intimate acquaintance with the physical and political geography of the districts they embrace. It is not enough to know the exact course of rivers or streams; one also wants to know their nature and peculiarities. From a delimitator's point of view, most rivers and streams afford good frontiers, except such as are liable to alter their courses or throw up islands; but a statesman must select a frontier which is not only good as a line, but which in other respects is likely to prove satisfactory. Small streams may be objectionable as likely to be the cause of quarrel in connection with drinking and washing rights, or water required for irrigation purposes. In the case of large rivers, it may be found that if the ownership of the banks were to be in different hands, the arrangements for the improvement of navigation, and for police supervision for fiscal purposes, would be likely to give so much trouble that it would be better to seek a frontier elsewhere.

Sir Thomas Holdich has referred to watersheds or water-partings as the best of all frontier natural boundaries, but I venture to think this statement should be modified, and that it would be better to say that they are *often* the best natural boundaries. As is the case with rivers, they should not be adopted without full geographical knowledge. In mountainous districts, when the line of water-parting is sharply defined and difficult of access, it is undoubtedly, next to the sea, the best possible boundary; but it often happens, even in very mountainous countries, that the main line of water-parting is not very clearly defined, and, as stated by Sir Thomas Holdich, the highest and most important peaks are frequently not on this line. In such cases it would often be preferable to select other crest-lines, or lines connecting peaks in preference to the main watershed. Such selection can, of course, not be made without a good map, and intimate acquaintance with the country. In some more

or less mountainous districts it will be found that most of the habitations and cultivated land are situated on the top of the principal ridges. There the water-shed would be a most undesirable frontier, and in countries in which the main rivers rise on flat elevated plateaux, or in low ground, it often becomes almost impossible to determine on the ground the exact line of water-parting.

A good frontier should cause as little inconvenience to the people living along it as possible, and therefore what I may describe as local requirements should be taken into consideration. For instance, tribal districts should not be interfered with more than necessary, villages and towns should not be cut off from their water-supply, or garden ground, or cattle posts; or, again, a stream should not be adopted as a frontier if the only practicable road between two towns on the same side of it necessarily crosses in some portion of its distance to the other bank.

There is one form of frontier which Sir Thomas Holdich inveighs against, and which certainly, from the surveyor's point of view, is most objectionable: I refer to lines of latitude and longitude, or straight lines connecting two points, the astronomical co-ordinates of which are specified. They are difficult and expensive to lay out on the ground, and when marked out and beaconed, are often difficult to recognize, and take no heed of what I have referred to above as local requirements. With reference to this, I should like to bring very forcibly to your minds the fact that these very objectionable artificial lines are frequently forced on statesmen, either by the absence of information regarding the district through which a boundary has to be drawn, or by such information as may exist being unreliable. It is better to adopt such lines than to find afterwards that mountains, streams, or places which have been specified do not exist, or are far removed from where they were supposed to be.

Sir Thomas Holdich proposes that, in cases where accurate information does not exist, agreements with reference to boundaries should be postponed till a survey has been made, but I am afraid this would only be practicable to a very limited extent. When international boundary questions arise, the relations between the states concerned are not unfrequently somewhat strained, and it may be necessary to come to some settlement at once. Under such circumstances, a good solution of the difficulty would appear to be, in cases where there is doubt as to the accuracy of existing maps, to agree to certain natural frontier-lines, provided they be found after survey to fall within a specified limited zone. When the country is almost entirely unknown, the best course to pursue would probably be to specify certain latitudes or longitudes as guiding-lines, which should be liable to be replaced by natural boundaries, provided suitable ones, within certain limits, could subsequently be found agreeable to all the high contracting parties.

Mr. H. J. Mackinder: Sir Thomas Holdich has distinguished rather strongly between the academic and the practical aspects of geography. Possibly, in some countries where the universities are a little more academic than in England, we might have to draw such a line strongly, but it is one of the ordinary criticisms of Oxford and Cambridge, passed by foreign professors for instance, that they are too little academic and too strongly practical. To our ultra-practical English mind this may sound an extraordinary position, but when we reflect that it is the function of an English university not only to produce professors, but also India civil servants, home civil servants, members of Parliament, and even prime ministers, I think we may claim that English universities have practical as well as academic functions. It is just because of that practical side of university work in this country that I value most the geographical teaching which it is now proposed to extend from the comparatively humble basis of the past few years.

The possibility of using the peaks fixed by Colonel Tanner and others, was based

on the fact that when the trigonometrical position of a point is set down, there is no possibility of doubting the meaning of the observer. If language were used with similar precision, if such terms as "foot of mountains" and "easterly direction," to which Sir Thomas Holdich referred, were used with undoubted precision by all those talking on geographical matters, then it would be possible to refer with similar correctness to statements in language, and not merely in mathematical symbols. It is one of the results of academic training that language is used with precision. If for that reason alone, I venture to hope we may obtain something of practical value even from the academic study of geography.

We all of us thank Sir Thomas Holdich exceedingly for drawing attention to this matter, and if I ask him to soften a little the frontier which he draws between the academic and the practical, I know that he will be the first to agree with my general ideas.

The PRESIDENT: Before asking you to pass a vote of thanks to Sir Thomas Holdich, I think I ought to refer to the matter to which he alluded; perhaps I ought to have mentioned it at the beginning of the meeting, namely, the arrangements that we have been making with the University of Oxford to establish a really useful and practical school of geography in this country. In the preliminary negotiations to secure that end, we have had the very great advantage of advice and assistance from Sir Thomas Holdich himself, and I am glad to say that I can now announce to the Society that our Council this afternoon passed resolutions which enabled me to tell the Vice-Chancellor of Oxford that the authorities there are in full and perfect accord, in the arrangement of a scheme for a school of geography, with the Council of this Society. We now have every hope of establishing such a useful and practical school as will, in the time to come, if not immediately, dispel that ignorance which has in former times cost us so very dear. We would also—for it is the duty of the Council of this Society to tackle all difficult geographical questions—attempt to sweep away that habit of incorrect definition and of absence of definition which has also cost us so dear. We have appointed a committee in order to define the meanings of geographical terms, and give to every feature and every fact in nature connected with geography its right name. It will be a difficult task, and the result perhaps will not be immediately adopted, but I cannot help thinking it will be a useful task, and I am quite sure we were bound in duty as a Society to attempt it. In that way we hope we shall remedy two great defects which have been pointed out to us by Sir Thomas Holdich—the ignorance of geography in this country, and the absence of clear ideas with regard to the meaning of geographical terms. We have the great advantage of Sir Thomas Holdich's counsel, the counsel of a man with the experience of many years of geographical work in the field, and able by his learning as well as by his practical knowledge to give us most valuable advice. I now propose to you a cordial and unanimous vote of thanks to Sir Thomas Holdich for his most interesting and suggestive paper this evening.

EXPLORATIONS IN ICELAND DURING THE YEARS 1881-98.*

By Dr. TH. THORODDSEN.

As I have previously observed, the lowlands occupy but an insignificant extent of the surface as compared with the plateau.

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* Continued from p. 274. Map, p. 576.

Setting aside certain relatively broad throats of valleys and certain river-deltas, the east and north of the island possess no lowland tracks. The only quarter in which there are lowlands properly deserving of the name is in the south and south-west of Iceland. Between Hornafjord and Mýrdalsjökull there is a narrow but perfectly flat strip of coast, formed of fluvial detritus brought down by the almost innumerable *jökull* (glacier) streams, which break forth from the clefts and glens of the plateau. These countless anastomosing glacial streams roll down great quantities of gravel to the plains, and wherever the surface of the earth is inundated by the icy-cold glacier water vegetation refuses to grow. All along the southern border of Vatnajökull the farms are confined to a few oases, widely separated from one another by wastes of barren sand and furious glacial torrents. Indeed, in many places the people have been obliged to move their dwellings higher up on the mountain-sides, in order to escape the inundations caused by the ungovernable glacial rivers. Glaciers appear in every glen, and often thrust themselves close up to the very walls of the homestead. In the county of Vester Skaptafell, the ice-mountains recede from the coast, giving room for broader belts of lowland; but there too the lowlands consist of sandy deserts and fields of lava, the latter having issued from the craters of the interior. These lowland tracts are for the most part thickly strewn with rolled fluvial gravels and sand; but at the foot of the volcano Katla the gravel is mingled with volcanic ashes and scoriæ, which imparts a different character to the landscape. Extensive areas of drift-sand are also tolerably numerous. They produce large crops of sandwort, *Elymus arenarius*, the seeds of which are gathered by the poverty-stricken inhabitants and used for both bread and porridge.

This coast (the southern) is destitute of harbours, all the fjords having been gradually filled up by the detritus carried down by the glacial torrents. The sea, too, is so shallow that it is extremely perilous for ships to approach near to land. Besides, a heavy surf rolls in towards the shore, frequently with such violence as to dam back the glacial torrents, so that in this way a string of lagoons are formed. When the wind blows straight off the sea towards the coast, the outflow channels of the lagoons are often temporarily closed, and the rivers, being unable to discharge their waters into the sea, overflow the adjacent regions.

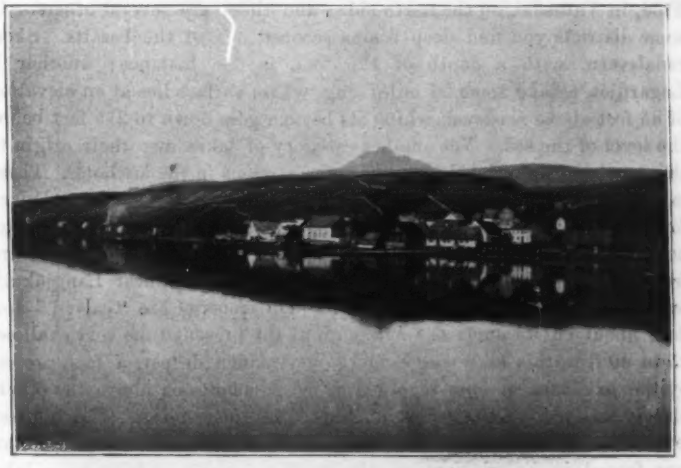
The largest continuous tract of level country in Iceland, a tract some 1550 square miles in extent, lies between the peninsula of Reykjanes and Eyjafjallajökull. My geological investigations have shown that this relatively low region is an area of subsidence bounded by faults reaching down to the foundations of the mountains. Here there have been constant changes going on all through the historical period, often taking the form of violent earthquakes, which more than

once have occasioned serious loss of life and property. The mountains which shut in this lowland plain are composed of tuff and breccia. In most places they present an abrupt escarpment to it, and everywhere exhibit unmistakable evidences of volcanic activity. Its elevation is but little higher than the sea-level, but the plain rises uniformly towards the interior, ramifying in some directions into deep narrow glens. Its maximum elevation does not exceed 400 feet, and occurs near the geysirs. West of Mount Heckla the lowland plain merges almost imperceptibly into the plateau, there being no barrier breaking the level slope which unites the two—an unfortunate thing for the inhabitants of the cultivated lowlands, since the pumice-dust and drift-sand blow down upon them unchecked. During the north-east gales the inhabited lowlands suffer considerably; indeed, more than once in the course of time whole districts have been rendered uninhabitable, as, for example, in 1836 and 1881. This lowland region is, for the greater part, grass-grown, and, being well adapted for the feeding of live-stock, is the thickest-peopled of any districts in Iceland. At the close of the Glacial period it was entirely covered by the sea. In places where the streams have laid bare the lower strata, the shells of numerous arctic bivalves have been found in the clay; occasionally, too, parts of the skeletons of whales come to light. At a later period, after the lowlands were raised above the permanent level of the sea, they were overflowed by a great number of gigantic lava-currents, which came down from the volcanoes on the plateau or from those along its borders. The largest currents issued from Mount Heckla and from the volcanoes at Fiskivötn. In many places, therefore, the lavas lie underneath the more recent humus.

There is also a stretch of low ground, extending to some 400 square miles, but not more than 100 feet above the level of the sea, around the head of the broad bay of Faxaflói. It is partly enclosed by a semicircle of steep basalt mountains rising to 1500 feet, and penetrated by several valleys of erosion. The surface here is broken by a great number of marshes and moors, intersected by low ridges of basalt, which are sometimes bare rock, sometimes overgrown with scrub, but which all alike show evidences of glacial scouring. This district, too, was covered by the sea in Glacial times, judging from the strata of clay and their interbedded remains of *Yoldia arctica* and other shells, and from several other indications that the sea once rose to a permanently higher level than it does now. Here again we have an area of subsidence; for the deposits of lignite, which crop out at a considerable elevation in the encircling mountains, show themselves, in consequence of the faultage, at a very much lower altitude in the basalt ridges. Chains of craters with an abundance of warm springs form a semicircle round the little plain. The fissures from which the springs generally issue run diagonally across the entrances of the glens or valleys. In fact, the

plain would appear to owe its origin to a *kesselbruch*, or the breaking down of the side of a basin, a phenomenon of which there are several instances in Iceland.

Iceland possesses numerous lakes, though the majority of them are of small size. The largest are Thingvallavatn and Thorisvatn, each slightly exceeding an area of 25 square miles. But the island possesses inexhaustible reservoirs of water in its numerous large glaciers. Indeed, all the largest of the lakes and rivers are fed directly or indirectly from glacier sources. The lake-basins owe their origins to various causes. Some are due to volcanic, some to glacial energy. Others, again, such as Mývatn, which is only from 6 to 23 feet deep, are merely depressions in the



AKUREYRI, ON THE NORTH COAST.

natural currents of the lava. This particular sheet of water, moreover, is studded with several craters, which project above its surface like islands; and all its immediate surroundings bear witness to great volcanic activity. A part of its supply is derived from springs in the lava. The group of lakes called Fiskivötn, west of Vatnajökull, consists for the most part of crater lakes. Between them and Vatnajökull stretches a wide lava waste, through which the water that melts off the glaciers filters till it reaches the lakes. Thingvallavatn is partly a lava lake, partly a glacial basin. Its southern portion is deep (about 425 feet), its northern portion shallower, and here the lake is bordered by currents of lava, which have flowed down between the great lava-fissures of Almannagjá and Hrafnagjá. The lake is also fed by subterranean affluents from the glaciers of Langjökull, whose water, after being filtered

through the intervening lava-beds, issues from several fissures near Thingvellir as bright and clear as crystal. South of the lake there are unmistakable raised beaches, demonstrating that at one time Thingvallavatn must have been both larger and deeper than it is at the present time. The shrinkage in its area is principally due to the fact that its discharging stream, the Sog, has worn down its channel to a greater depth.

In many places on the plateau, where former large ground-moraines associated with low mounds have deposited their *débris*, numerous lakes are found. One such example is the large group of lakes at Arnarvatn, north-west of Langjökull. Moraine lakes are also frequent in the valleys, as, for instance, Skriduvatn, in the east of the island, Flód, in Vatnsdal, on the north side; and there are several others. In some districts you find deep basins scooped out of the basalts. Skorradalsvatn, with a depth of 125 feet, is one instance; another is Lagarfljót, a lake some 25 miles long, whose surface lies at an elevation of 85 feet above sea-level, whilst its bottom goes down to 275 feet below the level of the sea. Yet another category of lakes owe their origin to the damming up of jökel (ice-mountain) streams in the lowlands. These lakes are extremely shallow, and frequently alter their shape and size; for example, the newly formed Dyngjuvatn, south of Askja. Large pools of water, caused by the melting of glacial ice and snow, are frequent along the edges of the glaciers. Hvítárvatn, near Langjökull, washes the foot of two glaciers, from which icebergs are "calved" and float about on its surface. Although at the present time very shallow, 25 to 40 feet, this lake was formerly very much deeper, a fact proved by the existence of four separate raised beaches, one above the other, plainly marked on the sides of the nearest mountains. The highest level was coincident with the close of the Glacial epoch, when the lake was fenced in by glaciers on the south as well. Langisjór, a lake 14 miles long, by ½ to 1¼ mile broad, wedged in between two sharply pitched mountain chains, on the west margin of Vatnajökull, is also a dammed-up glacier lake. Although vegetation does not thrive, the surroundings possess a certain wild romantic beauty of their own.

In many parts of the island there are numerous coast lagoons, but more especially on the north side, where are Hóp, Höfdavatn, and Miklavatn. The quality of the water in these lagoons, whether fresh, stagnant, or salt, depends upon the results of marine erosion and upon the nature of the outlet. The fauna of these coast pools is consequently liable to change. Sometimes salt-water species have free access into them; at other times the salt-water species disappear or become extinct, and fresh-water species predominate.

Iceland possesses several rivers of considerable size, their volume being due to the moist climate and the great number of glaciers. The Icelanders are wont to discriminate between "mountain water," which

is clear, and "jökel, or glacier water," which is of a milky-white colour. Taking the whole of the island into account, the glacier streams greatly preponderate. They vary in colour from a light milky-white to a rich chocolate-brown, according to the proportion of glacial clays which they hold in suspension. The other determining factors are the relative quantity of "mountain water" they contain, their nearness to the glaciers, and the greater or less degree of glacial melting consequent upon

HALLORMSTADASKOGUR, IN EAST ICELAND: THE HIGHEST BIRCH TREES IN THE ISLAND, 28 FEET.

the changes of temperature. Owing to these same causes the colour of the glacial streams varies also according to the seasons. In some short glacial streams the colour even changes in close accord with the varying warmth of the night and the day. But, as a rule, all the larger glacial rivers are tinged with colour all the year round. There is no place in Iceland where the peculiarities of the glacier streams can be so well studied as in the coast districts south of Vatnajökull. In that region innumerable *jökel* streams, most of them short, torrential, variable in

their courses, run down to the coast, to such an extent that clear water is almost unknown. In summer many of these glacial torrents spread out to such a great width, that it takes a good hour or two to ride across them. A large proportion of this time, however, is consumed in making *détours*, in order to escape the violence of the current and its deeper reaches. There are probably few places in the world where one can at the present day study under more favourable circumstances the geological conditions which prevailed towards the close of the Glacial epoch in Europe. In the regions of the flat sand the rivers are constantly changing their beds, sometimes more than once in the course of a single day; for their volume varies directly with the rate of melting of the glaciers. In the winter many of them shrink to a minute fraction of their summer volume. All the glacier streams possess the common characteristics of carrying down large quantities of pebbles and clay, and of spreading out over the lowlands in a network of anastomosing channels. Generally they emerge from their parent glaciers with a pretty steep fall, and gather heavy burdens of pebbles and *débris* from the moraines—so heavy, indeed, that when the strength of the current diminishes, the stream cannot carry its load, but drops it. The river-bed thus gets choked up; the current divides. The strongest branches force their way through the *débris*, encounter fresh obstacles, run into one another, coalesce with other branches, gain accessions of power, once more burst through the deposits of gravel, send off small side arms, again diminish in volume, and so go through the whole process afresh. Thus there is an unceasing struggle between the glacial torrents and the masses of gravelly *débris*, giving rise to an incessantly changing network of interconnected channels. One day a river branch will be swollen to the dimensions of a dangerous river; the next day it will contract to the compass of an insignificant rivulet. A minute often suffices to cause a stoppage, a division of the current, the carving out of a new bed. Some of these streams become dammed up till they form lakes, which overflow and inundate many square miles of the adjacent country. Some cut out such deep channels through the glacial *débris*, that they do not shift their courses for many years. One of these glacial torrents, therefore, often presents a picture of an extremely complicated network of hundreds of branches, enclosing between them a multitude of islands of clay and sand, which are equally as variable as the rivers themselves. It may be accepted as an invariable law, with regard to the glacial streams of Iceland, that they never empty themselves into the deep fjords. In all cases where they formerly did so, the fjords have become choked with sand, gravel, and clays. There are, however, a few places where the process of filling up a fjord is still actively going on; for instance, Borgarfjord, on the west coast, which receives the (river) Hvítá. Although this stream brings down a relatively small quantity of glacial clay, nevertheless during the last eight hundred or nine

hundred years it has levelled up the fjord to such an extent that, whereas in ancient times large trading-ships sailed up it without difficulty, at the present day small boats can only get up at the times of high water.

As I have already said, where the interior plateau is composed of palagonitic tuff and breccia, it slopes evenly down towards the sea—a circumstance which is not without its effect upon the direction of the longest and greatest rivers of the island. The Œlfusá, the Thjorsá, and the Markarfljót, all streams of considerable magnitude, flow down the natural slope of the plateau towards the south-west and the south. The Markarfljót divides and reunites many times before it empties itself into the sea, thus forming the largest delta (Landeyjar) in all Iceland. The Thjorsá, 125 miles long, is the longest river in the island. On the north side of the island nearly all the rivers flow due north. The largest stream on that side is the Jökulsá, which enters Axarfjord. The largest and longest glacier streams of the plateau originate at altitudes of 2000 to 3000 feet, these being the limits of altitude of the glaciers themselves. But although the rivers of Iceland carry down relatively heavy floods of water, they are not navigable; chiefly by reason of their steep fall, their torrential current, their tendency to spread out and subdivide into numerous branches in the lowlands.

Waterfalls are tolerably plentiful. The most important is Dettifoss, in the Jökulsá. The river plunges down a fall of 350 feet vertical height into a chasm some 12 miles long, which in all probability was originally a volcanic fissure. Many other waterfalls, some of them high, some of them picturesque, some of them uniting both characteristics, exist in different parts of the island. The best known are Skógafoss and Gullfoss in the south, Hengifoss in the east, and Dynjandi in the west. As an almost invariable rule, the larger waterfalls occur in places where tuff formations are overlain by basalt or dolerite; the upper rocks, getting undermined, break off and topple down.

The principal petrological constituents of Iceland are basalt and palagonitic breccias. Compared with these two formations, all other varieties of rock are excessively poorly represented. Nearly two-thirds of the entire area is basalt; palagonitic breccias occupy nearly the whole of the remaining one-third. The palagonitic breccias, which are of younger formation than the basalt, stretch in an irregular belt diagonally across the island.

The north, north-west, and east coasts are everywhere modelled on grand proportions, their profiles reaching from the top to the bottom of the basalt formation, in the same way as in the Færoe islands, except that the outlines are more imposing. The mountains front the ocean like cyclopean walls, towering up in some places to more than 3000 feet above its surface, the basalt being disposed in layers one above another in varying degrees of thickness. Not that they are universally

horizontal, for now and again a layer is wedged in between two others, in such a way that its thickness rapidly decreases the further it goes inland; and after a very short distance it disappears entirely, whilst its place is taken by another layer. A few small deposits of tuff and breccia occur interspersed among the basalt. Dykes are frequent; most of them pierce down through the entire series of strata. The basalt formation certainly extends to a total thickness of at least 10,000 feet, in all probability to a good deal more. So far as is known, the underlying sedimentary rocks do not crop out in a single locality throughout the whole of the island.

Seen from a distance, the basalt mountains have a monotonous and gloomy appearance; but a closer examination reveals tolerably wide divergence in the details. Some of the basalt layers are close-grained; others are coarse-grained and crystalline,—doleritic, porphyritic, scoriaceous, banded, amygdaloid; the last containing vesicular cavities more or less filled with such concretions as zeolites, quartz, calcedony, calc-spar, and so forth. In some districts the basalt is cleft into handsome columns; in others, into sharp-edged blocks of irregular shape; in others it presents a lamellated appearance. There are certain localities where olivine so greatly preponderates, that the basalt layers seem to consist almost entirely of this mineral. In other localities, again —for example, in Hrappsey *—I have found masses of almost pure anorthite embedded in the basalt. Iceland spar is distributed through a network of crevices in the basalt at Helgustadir, in the east of Iceland, and at Djúpidalur, in the west.† Numerous well-preserved fossilized plants, discovered in the basalt in several places on the west and north-west of the island, prove that the basalt is coeval in age with the Tertiary period. The fossiliferous layers occur about midway up in the vertical faces of the basalt, so far as they are visible in the fjords of the north-west peninsula. I have there traced most of them through their various levels; for, although originally deposited at the same horizontal level, they have subsequently been several times dislocated, and now exist at different elevations and at different angles. The tree-stems have been pressed flat. In that condition they are called by the Icelanders *surtarbrandur;* and this name is a convenient name to use for the whole of the Icelandic lignite strata. Hence we call them the "Surtarbrand formation." This formation is from 60 to 100 feet thick, and consists of diversely coloured strata of clay and tuff, intercalated with strata of lignite, surtarbrand, carbonaceous slates, etc. Leaf impressions occur in the white and grey clays, sometimes also in clay pans of a reddish or greenish colour. Vegetable fossils are best preserved at

* "Geologiske Iagttagelser paa Snæfellsnes," p. 15.

† "Einige Bemerkungen über die Fundorte des isländischen Doppelspathes," in *Himmel und Erde*, iii. pp. 182–187 (Berlin, 1891).

Brjámslækur, Tröllatunga, and other localities around Steingrimsfjord. The extensive forests which formerly grew in Iceland seem in some districts to have been overwhelmed by pumice ashes, in others by currents of lava. Pieces of the stems of trees are occasionally discovered in the scoriaceous crust of the lava. Silicated tree-trunks are not at all uncommon.* At the period when the surtarbrand and lignite strata were deposited, it is certain there were many marshes and small lakes scattered over the surface of the country; and it is equally certain that there were several rivers of pretty large size, because in certain localities—Leirufjord, for instance—there now exist considerable formations of conglomerates intermixed with sand and rolled gravel, to a thickness of more than 300 feet, which, it is reasonable to suppose, owe

FROM THE EAST COAST OF ICELAND IN THE AUTUMN.

their origin to some Tertiary river. From the existence of such a large river in such a place in the Tertiary period, we may infer that the island was then of much greater extent than it is at the present time. As a general rule the basalt layers all round the coast have a slight inclination inwards towards the transverse belt of tuff. The chief local exceptions to this rule are due to dislocations; this is especially true of the north-west peninsula, which is cleft right through by several semicircular faults. In a few isolated places the basalt mountains are

* "Surtarbrandens geologiske Forhold i det nordvestlige Island," *Geolog. Fören. Förhandlingar*, xviii. pp. 114–154 (Stockholm, 1896). In this paper I have described every locality in north-west Iceland in which surtarbrand has hitherto been discovered, and given profiles, maps, etc. The well-known palæontologist, Prof. A. G. Nathorst, of Stockholm, has kindly consented to examine and identify my collections of fossilized Icelandic plants.

built up of horizontal layers, standing out like a *horst*, or upstanding table, the surrounding country having subsided.

The tuff formation, which extends transversely across the island, belongs to a later period than the basalt. The appearance and composition of its constituent rocks differ greatly in different localities. The prevalent colours are various shades of brown. The tuff occurs partly in masses of fine-grained texture and yellowish-brown colour, partly in the form of breccias. The fragments, which are of widely different sizes, consist of compact basalt, dolerite, pumice, scoriaceous lava, volcanic "bombs," or large round stones ejected by the active volcanoes. The separate fragments are very often covered with a crust of tachylyte. In addition to these, tachylyte and fine-grained palagonite are of general occurrence everywhere; in fact, they frequently constitute the greater portion of the mountain masses. The tuff is very often pierced by intrusive dykes and many-branched veins of basalt. Sometimes the tuff is arranged in layers; sometimes not a trace of regular arrangement can be discerned. The entire formation appears to be made up of two separate divisions—one older, the other younger; and in many places the two varieties of rock are unconformable. This is the case, for example, at Œlfus and at Hafursey. In the desert region between the Skaptá and the Tungná (rivers), I discovered masses of tuff 1000 to 1300 feet thick, resting upon an older deposit of ice-scoured breccias. I am inclined to think that these more recent post-glacial tuffs are pretty widely distributed throughout the interior plateau.

In many places all over the island, in both the basalt and the tuff formations, although in relatively insignificant proportions as compared with them both, there occur small beds of liparite. It exists in small intrusive beds and dykes, which, being of a lighter colour, contrast sharply against the dark basalt, and consequently are often visible a long way off. All over Iceland I have discovered new beds of this rock; but the most extensive bed, covering an area of nearly 50 square miles, belongs to the east side of the island, between Héradsflói and Seydisfjord. The liparites vary very greatly both in colour and in structure; where vertical sections are exposed, the colouring is often richly variegated. Several varieties of vitreous rocks closely allied to the liparite, most frequently pitch-stone, generally occur in close association with it. A large proportion of the liparites have been metamorphosed by fumaroles. The places where such changes have taken place offer splendid opportunities to study the chemical disintegration and decomposition of the different varieties of rocks and minerals.* In

* I have described the several occurrences of liparite in numerous papers and accounts of my journeys. Some specimens have been examined petrographically by H. Bäckström, who has published the results in "Beiträge zur Kenntniss der isländischen Liparite," in *Geolog. Fören. Forhandl.*, xiii. (Stockholm, 1891).

the south-east of the island—for example, in Breiddalur, Lón, and Hornafjördur, as well as at Máfahlid in Snæfellsnes—I discovered granophyr in veins and intrusive dykes in the basalt. A large dyke of this igneous stone, overlain with basalt and interpenetrating it in a large number of articulated veins, occurs in the Slaufrudalur at Lón. In the same district, on each side of the Bay of Lón, there are two large and imposing peaks of gabbro, capped with basalt and seamed with veins of liparite and granophyr. The glacial streams which flow from the glaciers of Vatnajökull, also carry rolled pebbles of gabbro down to the lowlands. Possibly there are mountain masses of this rock buried under the *névés* of Vatnajökull.

In a single locality in the north of Iceland, namely, at Tjörnes near Husavík, I have met with extensive beds of shelly sand belonging to the Red Crag division of the Pliocen formation. Its situation points to a level of the sea some 150 or 200 feet higher than the existing level. In the vicinity there exist also deposits of surtarbrand, but unfortunately no leaf-impressions or other distinctive fossil remains of plant-life. The fossils* were identified in 1871 by O. A. L. Mörch, and, according to Gwyn Jeffrey, there are several American species amongst them.

In the year 1865, the Swedish geologist Paijkull called attention to the fact that the dolerites of Reykjavik had precisely the same structure as lava, and exhibited plain indications of glacial scouring; in other words, they were lava which had been ejected during or prior to the Glacial epoch. In my later journeys I ascertained that these doleritic lavas have a very large distribution in the west and south and north of Iceland. They are more especially associated with the districts which are built up of palagonitic breccias—that is to say, with the localities in which modern lavas are so common. The pre-Glacial volcanic eruptions obeyed the same laws, and took place along the same system of architectonic fissures, as the recent outbreaks. The pre-Glacial dolerites are mostly found underlying the great outflows of the modern lavas. At the time these pre-Glacial lava-beds were laid down, the country had pretty much the same essential contours that it has at present. They often rest unconformably upon the basalt and breccias. Like the recent outflows of lava, they issued from fissures in the earth, along which chains of craters were formed, and in some isolated places cones of lava. But all these older craters have disappeared, having been swept away by the glaciers of the Glacial epoch. I only know of a single locality in which a unique specimen of a well-preserved pre-Glacial crater still remains, and that is on the

* The collections of specimens which I made in that locality are not yet identified. The fossils which I collected in 1884 are preserved in the museum of the Academy of Sciences at Stockholm. Those which I gathered when with Johnstrup, in 1876, went to the Mineralogical Museum of Copenhagen.

summit of the mountain Bláfjall, 4020 feet high, which stands south of Mývatn. The glacial striations on the side of the mountain prove that during the Glacial epoch the highest portions, together with the ancient crater, projected like a *nunatak*, or island of bare rock, above the inland plain of ice. Thus the dolerites on the top of Bláfjall have preserved their superficial lava-like structure unchanged; whereas the mountain of Sellandafjall, in the same immediate neighbourhood, rising to a height of only 3285 feet, has been scoured by the Glacial ice.

Pre-Glacial lava-cones, with a crater opening on the top, exist in many parts of the island. They have but a slight inclination of two or three degrees, and closely resemble the more recent lava-cones, except that their superficial crusts of scoriæ have been scaled off, and the cones scoured by ice. In very many places these pre-Glacial lavas attain to a thickness of from 300 to 600 feet, and even more; and in all probability they are as widely distributed as the recent lava-streams. Some of the larger volcanoes of Iceland—for instance, Eyjafjallajökull, Œræfajökull, Snæfellsjökull—which have been in eruption within historic times, were also active prior to the Glacial epoch.

In many places of the west and the south I have discovered large deposits of pre-Glacial conglomerates, mingled with rolled gravel and sand, which seem to be analogous to the *nagelfluh* of the Alps. In some localities they appear to have been the first strata laid down after the excavation of the valleys; in others the contour of the ground seems to have been considerably changed since that period, especially by subsidence. A closer investigation will probably demonstrate that these conglomerate strata belong to different epochs. The presence of such large quantities of rolled gravel points in all probability to the action of rivers with a powerful current existing at a time when the precipitation was unusually heavy. Indications of a period of heavy rainfall, like that here supposed to have occurred just previous to the Glacial epoch, have been observed in other countries—for instance, Switzerland and America.

During the Glacial epoch the whole of Iceland was wrapped with a thick sheet of inland ice, through which only a small number of peaks projected here and there near its edges. At the time the ice-sheet was broadest and thickest, there can be little doubt that the *jökler* (ice-mountains) of the interior spread out their arms in every direction. The lateral and terminal moraines, however, which still remain in the valleys, date from a later period, after the ice had begun to retire. The north-west peninsula was in all probability covered by a separate ice-sheet, which sent numerous smaller glaciers with bare ridges between them down to the sea. In that part of the island ancient lateral and terminal moraines are much commoner than in the main part of Iceland. There, too, as in so many other districts, the moraine deposits have been greatly altered by the action of the sea in the course of its advance at

the expense of the land. The ice-sheet which covered the interior plateau during the Glacial epoch was at least 2500 feet thick; on the north-west peninsula it was 1500 feet thick. Its outward slope, like that of the existing ice-sheet of Greenland, was relatively insignificant and tolerably even. From Vatnajökull to the north coast it can scarcely have been greater than 0° 37′.

Glacial scourings are found all over the island, on every variety of rock which is older than the Glacial epoch—up on the plateau, down in the glens and valleys, on the lowland plains. I have measured the direction of the striations in more than two hundred places, and without exception all radiate outwards from the centre of the island towards the

THE VOLCANO SNÆFELLSJÖKULL.

coasts.* In several localities on the lowlands I have observed instances of intersecting striations. From this we may conclude that those districts have experienced more than one glaciation; but the observations are still too incomplete to warrant, with anything like safety, the deduction that Iceland has been visited by more than one Glacial period. The broad bays of Breidifjord and Faxaflói were both formed prior to the Glacial epoch, and both received glaciers from the mountain chain which traversed the peninsula of Snæfellsnes between them. On the whole, my geological investigations prove that the general structure and contour-lines of Iceland were in all respects essentially the same before the Glacial epoch that they are to-day. The disposition of the strata show plainly that the doleritic pre-glacial

* In 1891 I published in *Geogr. Tidkrift*, xi. plate ii., a map showing the direction of the glacial striations; but since then I have observed a great number of other instances in different parts of the island.

lavas, of which I have already spoken, are not of Tertiary age, but were ejected and laid down after the island had assumed the broad general characteristics of form and appearance that it now has, and show also that they rest unconformably upon the basalt and palagonitic breccias. South of Esja, on the east side of Faxaflói, the pre-Glacial lava-streams have flowed down the slope from the plateau, and filled up the valleys and depressions between the ranges of basalt and breccia. The same thing may be observed in the Hnappadalur, in Snæfellsnes, the Flokadalur, and several other districts. Now all these doleritic lavas exhibit unmistakable evidences of glacial scouring, so that they must be older and anterior to the Glacial epoch, and the depressions and valleys through which they have flowed must be older still.

Hundreds and thousands of large erratic blocks are scattered all over Iceland; but they afford no data of a reliable character for determining the distribution and movement of the jökler of the Glacial epoch, for the similarity of structure common to the mountain rocks throughout wide regions often make it impossible to determine the original provenance of the boulders. Nevertheless, boulders are often met with which have a different petrological composition from the rocks they rest upon; and a close examination of the local conditions frequently affords pretty safe indications for inferring this or that as to the movements of the glaciers during the Glacial epoch.

Signs of the coast-line having receded since the Glacial epoch are very common all round the coasts of Iceland, but nowhere are they so common or so well developed as in the north-western peninsula. Every part of the cliff-bound coast bears indications of pebbly marine terraces, coast-lines, surf beaches marked on the solid rock. In many places remains of shells have been found, sometimes also parts of the skeletons of whales and walruses, as well as ancient drift-timber, at considerable distances from the present line of coast. Round the north-western peninsula there are plain, well-developed coast-lines or raised beaches, and surf-beaches at two distinct levels—one at about 250 feet, the other at about half that height above the present sea-level. The same phenomenon of a double beach occurs on other parts of the coast. The lower of the two is visible all round the island; the upper is more seldom present, as well as less clearly marked. Caves, hollowed out by the surf when the sea was at a permanently higher level than it is now, are pretty general on the south coast. As I have already observed, towards the close of the Glacial epoch the lowlands were overflowed by the sea, which also penetrated some distance up the valleys in many places on the north and east of the island. In the south-west of Iceland there exist important argillaceous strata containing *Yoldia arctica* and other arctic bivalves at an elevation corresponding to the higher of the two ancient sea-beaches which I have just mentioned. Other mounds of shells, belonging to a fauna which resembles that now

existing in Iceland, occur at elevations answering to the lower of the two ancient sea-beaches. The species *Saxicava* is especially characteristic of these mounds of shells. The coast has been steadily and constantly receding ever since the Glacial epoch, and the movement appears to be still going on, although at such a slow rate that it has never been actually measured.*

At the present time the *jökler* of Iceland cover an area of 5170 square miles. The climate of the island is peculiarly suited for the development of large glaciers, the atmosphere being raw and cold and moist, the precipitation plentiful, and the amount of summer warmth but small. The precipitation is, however, very different in different parts of the island—for instance, in Berufjord, in the south-east, the annual rainfall amounts to 42½ inches; at Stykkisholm, in the west, to 25½ inches; and on the island of Grimsey, off the north coast, to 16 inches. The precipitation is consequently heaviest on the south-east coast, and it is in that quarter of Iceland that the ice-clad mountain mass of Vatnajökull covers such a vast area of the plateau. In the south and south-west districts the weather is at all times very changeable and stormy. Snow seldom lies long in winter on the lowland plains. Frost and thaw alternate several times in the course of a single day. Indeed, it often happens that for months together in the winter there is not a particle of snow to be seen on the lowlands of the south. On the other hand, it rains very frequently; but whilst it rains on the lowlands, it is often at the same instant snowing heavily in the elevated interior. For a series of years I have taken observations at Reykjavik of the number of days during which the ground has been covered with snow. The period is much shorter than one would suppose. In the winter of 1889–90, snow lay on the ground only ninety-six days; in 1890–91, only eighty-four days; in 1894–95, not more than fifty-six days. In the north of the island, on the contrary, snow lies for a very much longer period. From observations made on the coast, it would appear that the climate of Iceland is typically insular, the winters being relatively mild, and the summers cool. Up on the plateau there is unquestionably a much greater difference between the winter mean and the summer mean; but, unfortunately, we possess no data from that region. In the subjoined table, which was worked out at the Meteorological Institute in Copenhagen, I give observations taken at only one station on the plateau, namely Mödrudalur, which lies at an elevation of 1640 feet above the sea. As a single glance will show, the temperature there has a much greater range than at the other stations.

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* "Post-glaciale marine Aflejringer, Kystterrasser, og Strandlinjer i Island," in *Geogr. Tidskr.*, xi. pp. 209–225, with a map.

Mean Temperatures for the Period 1874–92; *the Readings being those of the* Centigrade *Scale.*

Name of station.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Stykkisholm (W. Iceland)	−2·2	−2·6	−2·5	0·8	4·1	7·9	9·7	9·2	7·2	3·8	0·7	−1·7	2·9
Eyrarbakki (S. Iceland)	−2·2	−1·6	−1·8	2·3	5·8	9·2	11·1	10·3	7·4	3·4	−0·2	−2·3	3·5
Berufjord (E. Iceland) ...	−1·6	−1·4	−2·2	1·0	3·6	6·7	8·3	7·9	6·4	3·3	0·8	−1·2	2·6
Akureyri (N. Iceland) ...	−3·7	−3·5	−3·8	0·6	4·2	8·8	9·9	8·8	6·7	2·2	−1·3	−3·3	2·2
Vestmannaeyjar (off S. coast)	1·0	1·3	1·2	3·9	6·4	8·7	10·6	9·9	7·8	5·1	2·7	0·9	5·0
Mödrudalur (on plateau)	−8·1	−6·8	−7·8	2·4	2·1	8·3	9·2	6·9	3·7	−1·3	−5·1	−7·7	−0·8

The temperature of Iceland varies very greatly from year to year, and also the mean of the separate months. For instance, take the month of March: at Stykkisholm the highest mean in a period of thirty-eight years was 4·3° C. (39·7° Fahr.); the lowest mean in the same period, −13·3° C. (8·1° Fahr.). This excessive variability in the temperature exercises great influence, not only upon the quantity of the snow which falls, but also upon the altitude of the snow-line, to say nothing of the injurious effects it has upon the food-supplies of the people. The factor which exercises the greatest influence of all upon the climate is well known to be the Greenland drift-ice. When the ice appears off the north coast, the temperature immediately falls. In May and June, when the people who dwell in the south of the island perceive that it is snowing on the mountains, they at once take it as a sign that the dreaded drift-ice is about to invest the north coast. During the nineteenth century that coast has been free from ice about one year in every four or five.* So long as the ice drifts backwards and forwards along the coast, the weather continues to be very changeable and stormy; but once the ice gets set fast to the land, the weather becomes more settled, though colder. The parts of the coast which are most subject to be blocked by the drift-ice are the north and east sides of the north-west peninsula (county of Strandir), and Langanes and Melrakkaslétta, at the north-east corner of the island. The effects of the presence of the drift-ice in those regions are manifested both in the greater extension of the snow-wreaths and in the character of the vegetation. Owing to the constant coldness of the springs and the rawness of the summers, vegetation is extremely stunted and poor.

* *Vide* "Den grönländska Driften vid Island," in *Ymer*, pp. 145–160 (Stockholm, 1884). This paper contains all the information that I have been able to collect from Icelandic sources, published and unpublished, about the drift of the ice along the coast of Iceland, together with a table showing its range during the different months all through the nineteenth century. I have a series of important notes drawn from the Icelandic annals of different centuries, and dealing with the climatology and meteorological conditions of the island, which I have only in part arranged and worked up. As yet none of these results are published.

Before I began my investigations, there existed absolutely no observations of the height of the snow-line in Iceland. Accordingly I made it my special object to remedy the defect, by noting the snow-line in various districts, as well as the limits of the glaciers and their periodical changes. The accurate determination of the snow-line in Iceland is not at all easy, owing to the extreme variability in the climatic conditions. I have found it convenient to discriminate between three different boundary-lines for the vertical deposition of the snow, depending upon meteorological and orographical conditions. The snow-line, in the ordinary acceptation of the term, that is, the boundary-line marking the

THE RIVER HVÍTÁ, IN BORGARFJORD.

lowest edge of the snow which covers the mountains perpetually in one unbroken sheet, does not vary much from year to year. Below that, however, lies a belt of detached patches of snow, more or less closely packed together; these never thaw entirely, but increase and decrease according to the character of the year. Below this belt again stretches the skirt of the snowy mantle which is most changeable—scattered drifts of snow which are relatively dependent upon such orographical conditions as altitude, aspect, and so forth. It sometimes happens, that these drifts remain without melting for several years, if they are years characterized by cold and moist atmospheres; but if the seasons come warm or dry, they shrink to a minimum or even disappear entirely. I have only space to cite a single example. On the east side of Drangajökull, in the

north-west peninsula, the snow-line runs at 1300 feet above sea-level; but on its west side it runs at 2100 feet. On the plateau itself, all around the base of the same mountain, at altitudes of 800 to 1300 feet, there are a vast number of detached snow-drifts, equal to an aggregate area of 70 or 80 square miles. But in the summer of 1886 I observed numerous patches of snow at an even lower level, and in sheltered spots quite close down on the edge of the sea. The same relative phenomena occur in several other parts of the island. The next table (p. 499) will show how the snow-line varies in different districts, the variations being principally due to the varying amount of the precipitation.

The great ice-mountains of Iceland are without exception closely associated with the interior plateau. Ice-sheets of great thickness and with an undulating surface, and *firn* (coarse, half-solidified snow), with a gentle inclination, cover extensive areas on the highest parts of the plateau. Isolated mountain peaks are rare. They are mostly ranged near the edge of the plateau, and very often are merely the outstanding summits of the underlying rocks. There is no gravel visible on the surface of these snow-fields. Gravel only appears at the ends of the glaciers, and they are often quite black with it and with fragments of rock. The great Icelandic *jökler* have a quite different appearance from the *firn* and ice-masses of the Alps. They resemble more nearly the type of glacier which is characteristic of the polar regions. Still, in some places along the borders of the plateau there are smaller glaciers which do present a somewhat similar appearance to the Alpine glaciers. In the Alps the *firn* basins are only of small area, but the glacier-streams, in comparison with them, extend to a relatively enormous length. In Iceland, on the contrary, the *firn* basins are of great extent, whilst the glacier flows are short; but at the same time they are often of considerable breadth, so that their resultant area is in many cases large. Several of the glaciers of Vatnajökull stretch over an enormous area. For instance, Dyngjujökull covers 155 square miles; Skaptárjökull, 195; Brúarjökull, 195, and so on. These, however, far exceed all other Icelandic glaciers in extent, being comparable to some of the Greenland glaciers. In fact, Vatnajökull might very well be regarded as a relatively small instance of inland ice-formation.

I have already stated that the aggregate area of the *jökler* of Iceland amounts to no less than 5500 square miles. The glaciers of Switzerland cover an aggregate area of 710 square miles; and those of the Alps throughout, from the one end to the other, slightly exceed 1160 square miles. The area covered by glacial ice in Norway is much about the same; that of Sweden, 155 square miles. Thus the only parts of the world in which there exist glaciers comparable in size to those of Iceland are the stupendous masses of ice in the polar regions. In this place I have not space to enter upon a detailed description of the individual glaciers of Iceland. I can only refer for particulars

to my longer papers on the subject,* merely giving here a table in which the more salient data are succinctly recorded.† Of the older publications dealing with the glaciers of Iceland, the most complete, as well as the most accurate, is the paper by Sveinn Pálsson, written in the year 1794.

Names of glaciers.	Area in square miles.	Maximum height above sea-level in feet.	Absolute altitude of snow-line in feet.	Number of glaciers known	Altitude of inferior end in feet.
Gláma	90	2955	2130	—	—
Drangajökull	135	2920	—	7	—
„ east side	—	—	1310	—	100
„ west side	—	—	2130	—	80
Snæfellsjökull	10	4710	—	2	1640
„ north-east side	—	—	2725	—	—
„ north-west side	—	—	3280	—	—
Langjökull	500	4595	—	28	—
„ south-west side	—	—	2950	—	1970
„ east side	—	—	3280	—	1475
Eiriksjökull	40	5900	—	5	—
Ok	15	3900	—	—	—
Arnarfellsjökull	520	5250	—	15	—
„ south side	—	—	—	—	1810
„ north side	—	—	3935	—	2945
Mýrdalsjökull	385	5595	—	19	—
„ north side	—	—	3610	—	2300
„ south side	—	—	1970	—	165
Torfajökull	40	*c.* 4600	3115	—	—
Tindfjallajökull	10	—	—	2	—
Vatnajökull	3280	6425	—	33	—
„ west side	—	—	3280	—	2085
„ north side	—	—	4265	—	2510
„ south side	—	—	2000	—	30
Hofsjökull (south-east Iceland)	30	3610	—	1	1640
Thrandarjökull	25	3610	—	—	—
Snæfell	5	5980	—	2	—
Tungnáfellsjökull	385	*c.* 5250	—	2	—
Several small glaciers on the north and east of Iceland	75	3950 to 4250	—	8	—
Totals	5515	—	—	124	—

* See "Islands Jökler i Fortid og Nutid," in *Geogr. Tidskrift*, xi. pp. 111–146, besides accounts of my several journeys in the same periodical, and in the Icelandic journal *Andvari*. My observations on the changes which Icelandic glaciers undergo have been worked up by M. Ch. Rabot, in a paper entitled "Les Variations de Longueur des Glaciers dans les Régions Arctiques et Boréales,' in *Archives des Sciences Physiques et Naturelles*, vol. iii. (Geneva, 1897). Compare also the same author's "Les Volcans et les Glaciers d'Islande d'après les Explorations de M. Thoroddsen," in *Nouvelles Géographiques*, 1894, pp. 97–103, 119–122.

† I published a similar table in *Geogr. Tidskrift*, 1891, and in *Petermanns Mitteilungen*, 1892. But since those dates I have examined a great number of additional glaciers, especially in the south-west and north of the island, so that the table which immediately follows is more complete than the former ones. For one thing, the number of glaciers, from which the data are drawn, has increased from seventy to one hundred and twelve.

Sometimes the volcanoes which are buried underneath the glaciers break out into eruption, bursting and melting the glacier above them, and giving rise to what is known as a "*jökel* flow," or in Icelandic *jökulhlaup*, a phenomenon peculiar to Iceland. When this happens, the broad beds of sand which lie at the foot of the *jökler* are inundated by a foaming flood of turbid water, with large fragments of ice tossing on its surface. And as the ice and the flood both carry with them inconceivable quantities of gravel and pieces of ruptured rock, these catastrophes sometimes cause serious alterations in the contour relations of the surrounding country. The volcano Katla has occasioned probably as great changes as any in Iceland in precisely this way; having completely filled up the fjord in the course of time, and very materially changed the coast-line. When this mountain was in eruption on May 11, 1721, such an enormous number of fragments of ice were shot out over the sea, that it was not possible to see across the floating ice-field even from the summits of the highest mountains in the neighbourhood. The biggest of the ejected bergs grounded 3½ miles from land, at a spot where the sea was 420 to 500 feet deep. At Höfdabrekkufjall the eruptive torrent was 350 feet deep, and at Hjörleifshöfdi, a rocky pinnacle 125 feet high was swept bodily away. During the outbreak of 1755 a ridge of gravel and ice, 12 miles long and 130 feet high, was left right across the Myrdalssandur. Œræfajökull, which is sheathed throughout in ice, has been in eruption several times. The most destructive outbreak occurred in the year 1350, when in the course of a single morning two parishes, embracing forty farm-steads, and two manses and their buildings, perished in a jökel flow. In the nineteenth century jökel flows have been frequent from Skeidarárjökull; they proceed, in all probability, from a volcano which lies buried under the snows of Vatnajökull. Minor jökel flows are also pretty common, caused by dammed-up rivers and small lakes in the glaciers periodically bursting their icy barriers, and inundating the lowlands.

Iceland ranks amongst the countries in which volcanic energy is most active, and the activity manifests itself under conditions which are especially interesting to geologists. For this reason, I made the investigation of the volcanoes an object of careful study throughout all my journeys. I have had the good fortune to visit every volcano in the island. Of these the greater part were previously unknown to geologists. I have drawn maps of most of them, but only a few of my maps are as yet published. In the relatively rich historic literature which Iceland possesses, we are fortunate enough to have numerous records of volcanic outbreaks in the island in both ancient and modern times. Most of these records exist in manuscripts preserved in the public libraries in Denmark and Iceland, and in private collections; but only a very few of them are as yet printed. All these accounts I compiled before beginning my exploring journeys, and digested them

into a book in which I related the history of the Icelandic volcanoes.* Some day I hope to publish the original sources *in extenso*, having taken accurate copies of them. To describe all the volcanoes of Iceland, and relate their every eruption, in this present paper, would spin it out to an inordinate length. I must confine myself, therefore, to a brief general survey, referring for further particulars to my other publications.†

The lava-fields of Iceland, which have flowed out since the Glacial epoch, cover an area of 4500 to 5500 square miles, and lie scattered in vast expanses around the volcanoes from which they have issued. Most

CLIFFS AT THE COAST OF SKAGI, NORTH ICELAND (BASALT).

of them are the result, not of one, but of several volcanic eruptions occurring at different periods; but the major part are traceable to pre-historic outbreaks. The most extensive lava-field in the island,

* 'Oversigt over de islandske Vulcaners Historie. Avec un résumé en français' (Copenhagen, 1882), 8vo, 170 pp. There is a map appended to the volume. Extracts from this book were printed in the *Geological Magazine*, decade ii. vol. vii. No. 10, October, 1880, pp. 458–467; also in the *Report* of the Smithsonian Institute, Washington, 1886, 47 pp., as well as in *Gæa*, xix., 1883, pp. 464–470.

† The volcanoes of Iceland are described in most of the accounts of my journeys through the country, and in the geological papers which have been already cited. See more especially the articles, "Vulkaner i det nordöstlige Island" and "Vulcaner paa Reykjanes." Besides these, I have written a little book, entitled 'Vulcaner og Jordskjælv paa Island' (Copenhagen, 1897), with 21 diagrams and 6 maps; also "Nogle Bemerkninger om islandske Vulkaner og Lavaströmme," in *Geogr. Tidskrift*, xiii. pp. 140–156.

Odádahraun, which lies on the plateau north of Vatnajökull, at an altitude ranging from 1600 to 3500 feet above sea-level, has an area of 1300 square miles, or counting in all its branches, and all the smaller lava-streams associated with it, its aggregate area runs to 1700 square miles. It owes its existence to innumerable outbreaks from more than twenty volcanoes, the largest of them being Askja. The cubic capacity of the body of lava which in this one place has been ejected from the bowels of the Earth, amounts to a solid cube each of whose sides would measure about 50 miles. The next largest lava-field in the island has originated from several craters of considerable size around Fiskivötn, west of Vatnajökull; it stretches right down to the south coast at Eyrarbakki, and covers an area of 770 square miles. The lava-streams in the peninsula of Reykjanes cover 730 square miles.

The *ejecta* of the Icelandic volcanoes that have been in eruption since the Glacial epoch have been partly liparitic lavas, partly basaltic lavas. The eruptions of liparite have, however, been relatively few, and both their area and their volume are insignificant when compared with the area and volume of the basaltic lavas. The vast deserts of lava, ashes, and scoriæ, which form such a characteristic feature of the island, consist exclusively of basaltic lavas. Previous to the year 1889, only one solitary liparitic lava-stream of age subsequent to the Glacial epoch was known in Iceland, namely, Hrafntinnuhraun; but in that year I had the good fortune to discover three new lava-fields, of a very interesting character, north of Torfajökull.* Seen from a distance, they look like gigantic mounds of coal, for their surface is coated with obsidian. The liparitic lavas, with their heavy blend of silicic acid, flow in a much denser stream than the basaltic lavas. Consequently the currents of the two present a marked superficial difference. The liparite currents are very deep relatively to their length, and have an extremely uneven superficies. Their salient details are exhibited in four typical instances in the subjoined table:—

Locality.	Area, square miles.	Depth in feet.	Proportion of SiO_2.
Hrafntinnuhraun	10	65	69·70
Dómadalshraun	6½	50	69·81
Námshraun	1½	65	62·72
Laugahraun	1¼	165	68·27

The great mass of these four lava-outflows consists of a light grey rock, covered by a thick coating of obsidian, whilst the top or superficial

* "Om nogle postglaciale, liparitiske Lavaströmme i Island," in *Geolog. Fören. Förhandl.*, xiii. pp. 609–620, 1891; and see also H. Bäckström, "Beiträge zur Kenntniss der isländischen Liparite," *ib.*, pp. 637–682.

layer is generally a greyish white pumice. There are also many extremely beautiful transitional forms between these several constituents. The predominating grey rock is streaked with veins and bands, which sweep up and down in wide loops and coils. Along the lines of these veins the rock can be easily cleft into thin slates. In prehistoric times the liparite mountains of Iceland seem to have been the scene of several eruptions of the same peculiar character as the eruptions which Junghuhn describes as occurring in the trachyte mountains of Java; for instance, the outbreak of Galungung in 1823. Vast outflows of half-melted and unmelted masses of liparite, poured out from cauldron-shaped depressions, stretch down into the lowlands. Examples may be seen in the Borgarfjördur, in the east, at Drápuhlidarfjall, in the west; but in the most pronounced form, in Lodmundarfjord, on the east coast. In a few solitary cases, liparitic pumice has been ejected by basalt volcanoes; for instance, by Snæfellsjökull, Œræfajökull, and Askja. Fragments of granophyr were discharged by the crater Víti near Mývatn on May 17, 1724.

The basalt volcanoes of Iceland may be grouped under three typical forms—cone-shaped volcanoes, lava-cones, and chains of craters; the last being by far the commonest. Of the 107 volcanoes which I examined in the course of my journeys, eight were built up of alternate layers of lava and ashes (the typical form of Vesuvius), sixteen were lava-cones (the form of which Mauna-Loa is typical); but the crater-chains numbered not less than eighty-three. And this includes only the chains of larger volcanoes, in which many of the separate craters have been the scenes of violent eruptions. In addition to these, there are numerous chains of smaller volcanic vents and fumeroles. It is a well-established law of volcanic activity in general, that all volcanoes have been thrust up along the great structural lines of fracture on the crust of the Earth. This law holds for the most part in Iceland. It was long ago observed that the volcanoes in the south of the island are grouped along lines which stretch from the south-west to the north-east; and it was believed that they only exist where the substratum consists of tuff and breccias. It is a fact that volcanoes are most prevalent in districts in which breccias predominate; nevertheless that is not exclusively the case. During the course of my journey in 1890, I discovered on Snæfellsnes, and around the Bay of Faxa, a number of volcanoes which had forced themselves up through the basalt, alongside open fissures, and in conjunction with hot springs, in a regular semicircle all round the bay. In the middle of the island, the greater number of volcanoes stand, as I have already said, on a tuff foundation. In the south they stretch in lines from the south-west to the north-east; on the north side in chains running from north to south. Thus, taking them altogether, they form a sort of curve, going obliquely right across the island. The whole of the tuff formation is an area of subsidence. Its many fissures were seats of great activity long before the Glacial epoch, and the activity

has continued right down to the present day. So far as is known, twenty-five volcanoes have been in eruption within historic times.

Large cone-shaped volcanoes, built up of alternate layers of ashes, scoriæ, and lava, and resembling in external form the well-known Italian volcanoes of Vesuvius and Etna, are, as I have remarked, not particularly common in Iceland. Their general appearance is sufficiently familiar, resembling a truncated cone with a crater at the top, and often with several smaller lateral craters. The pitch or angle of inclination of the cone depends upon the materials out of which it is built up. In Iceland volcanoes of this class rise at an angle of from 8° to 15° near their base, and shoot up at from 20° to 35° near their top. Most of them are lofty, and consequently are covered with glaciers; for instance, Œræfajökull (6425 feet), Eyjafjallajökull (5595 feet), and Snæfellsjökull (4710 feet). Hekla (5110 feet) is also built up of alternate layers of lava and tuff, but it is not cone-shaped. Its shape conforms to an elliptical ridge, cleft down its major axis, and studded with a chain of craters along the line of cleavage. It is thus an intermediate form between the cone-shaped volcano and the chain of craters. The largest volcano in Iceland, Dyngjufjöll,* with the gigantic crater of Askja, some 25 square miles in area, is likewise an intermediate form. The mountain walls which encircle Askja, and rise to an absolute altitude of 4600 feet, and a relative altitude of 3000 feet, are constituted of ancient and modern lavas and tuffs; and the multitude of crater-chains which line the fissures do not radiate outwards from the centre of the volcano, but cross them irregularly in all directions.

Lava-cones, that is, volcanoes with a slight angle of inclination, and built up entirely of lava, are, on the other hand, very common all over the island. Strange to say, the older geologists who have written about Iceland do not appear to have specially observed this general type of volcano. These lava-cones, which range in size from mere hillocks to the largest mountains in the island, are distinguishable from the country surrounding them, in that they resemble a shield with its convex side uppermost; but, as compared with their extent, their altitude is relatively low. One well-known example of this type is Skjaldbreid, a beautifully formed "dome," which overlooks the heights behind the historically famous Thingvellir; it is like a broad shield, emblazoned with patches of white snow. The angle of inclination on these lava-cones is pretty uniform, seldom exceeding 7° or 8°, more frequently less, often only 1° or 2°, and being at the top but very little steeper than near the base. Their slopes are cased in sheets of granulated lava, and large caves and tunnels are very common in the mountain-sides. The cones generally stand upon a base of vast circumference, and sometimes

* "Vulkane im nordöstlichen Island," in *Mitteilungen d. k.-k. geographischen Gesellschaft in Wien*, 1891, pp. 117–145 and 245–288.

run up to a considerable height, the top being broken by a circular or elliptical depression, or mouth, of large diameter.

Examination of the bottom of these craters proves them to have been at one period lakes of molten, liquid lava (like Kilauea), the surface of which has now swollen upwards, now sunk, and sometimes they have overflowed, pouring vast currents of lava down the mountain-sides to a great distance into the valleys and dales. Sometimes again, after the lake surface has cooled and set, portions of it have been melted again by the underlying heat. Thus fresh outbreaks have occurred, giving origin to smaller cauldron-shaped funnels, which in many cases go down to a great depth. The confining walls of the subsidence (crater) are mostly cleft by rings of concentric fissures, so that they go down from the lip to the bottom of the crater, as it were, in a series of steps. In some cases the crater is completely filled with lava, and the only indication of its circumference is a ring of small lava-pinnacles. The immense lava waste of Odádahraun has been mainly formed by eruptions from this class of volcanoes. The subjoined table will, I hope, give some additional facts about these lava-cones.

Name of volcano.	Absolute altitude in feet.	Relative altitude in feet.	Angle of slope.	Length of crater in feet.	Breadth of crater in feet.
Skjaldbreid	3490	1955	8–10° to E. 4–6° to S.W.	—	920
Heidinhá	2090	1645	2° to W. 3° to S. and E.	625	625
Selvogsheidi	600	600	2–3°	—	—
Skálarfell	270	270	4–5°	310	260
Háleyjarbunga	145	145	3°	455	455
Strytur (in Kjalhraun) ...	2650	—	1–2°	3000	3000
Theistareykjabunga ...	1770	195	1° to W. 4–5° to E.	11,000	2500
Kollóttadyngja	3965	1650	6–7° to N. 8° to S.	1650	1650
Ketildyngja	3115	1805	1–2°	3445	2065
Tröllladyngja (in Odáda-hraun)	4890	1970	3–4° at bottom 6–7° at top	3610	1245

The most general form of volcanic formation in Iceland is that of a chain of craters closely following the natural fissures of the ground, and being associated with them throughout their entire length. The separate craters are mostly low, seldom exceeding 350 feet in height, and are composed of loose scoriæ of a dark or brick-red colour. The cones generally slope at an angle of from 20° to 35°, though the inclination is determined by the size of the fragments of ejected material. In some cases the crater gets choked with viscous lava; then the cone is wont to be very steep, occasionally as much as 40° to 50°. The grouping of the separate craters that belong to one linked system is apt to be extremely irregular and complicated. A slight change in the fissure causes the actual point of outflow to shift further on, and in

this way there originates a succession of crater rings intersecting one another. Then, again, there are several vents on the circumference of one and the same cone; and sometimes a number of crater rings lie concentrically, one inside the other. The crater chains often extend to a great length. Several of those on the peninsula of Reykjanes are 3 to 10 miles long; but the longest in which there has been volcanic activity within historic times is that at Laki, where there were eruptions in 1783. That chain is nearly 20 miles long, and contains about one hundred craters. On the other hand, others of these crater chains are on an extremely small scale. For instance, south of the large crater, Ketil Dyngja, in Odádahraun, I discovered a Lilliputian volcano, or rather twelve craters, of which the largest had a diameter of 3 feet 4 inches—the others being only 5 to 6 inches across—and all ranged alongside a fissure that was not more than 35 feet long and 4 to 5 inches wide. And yet these miniature volcanoes had hurled lumps of lava to a distance of 15 or 20 yards. There are also several places where the lava has welled up out of fissures without any visible crater. Such fissures are generally small. Nevertheless, some few are exceptionally large; for example, Eldgjá, north of Mýrdalsjökull, which, as I have already stated, is nearly 20 miles long, and has ejected sufficient lava to cover an area of some 270 square miles.

Here and there in different parts of the island one comes across cauldron-shaped depressions (*maar*) in the surface, which have been produced by an instantaneous volcanic explosion. One of the best-known instances of these "explosive" craters is Viti, on the side of Mount Krafla, north of Mývatn. The circular depression was formed by a quite sudden outburst on May 17, 1724. The eruption only lasted a short time, though long enough to start several other volcanoes in the neighbourhood. It was accompanied by a heavy emission of steam, but the only volcanic *ejecta* were ashes and stones. The same crater, which has a diameter of 1030 feet, changed in 1752 into a well of boiling mud, and began to send forth columns of thick smoke and mud. This went on until the year 1840, and then it became converted into a greenish-coloured quiescent lake. A crater of a similar character was formed in the side of Askja through a violent outburst on March 29, 1875. Although measuring but 290 feet in diameter, it shot out such enormous quantities of liparitic pumice that they covered a surface of nearly 2000 square miles in the east of the island, and the volcanic dust was blown all the way to Norway and Sweden. The year after the outbreak the crater was full of steam, but when I visited it in 1884, the only sign of activity was the bubbling and boiling of the bluish-green clay at the bottom of the crater. In all probability this too will, in the course of time, be converted into a little peaceful lake.

Occasionally there have been volcanic eruptions in the sea off the coasts of Iceland, principally off Reykjanes. The volcanic disturbance

was most active there during the thirteenth century, five or six eruptions being on record from that period. Several times scoriaceous islands were formed, but they speedily disappeared again. Over against Tjörnes in the north, submarine volcanoes have been in activity at intervals, but more noticeably since 1868. A map by Johannes Ruysch, of the year 1507, shows an island between Iceland and Greenland, and underneath it is this inscription: "Insula hæc anno 1456 fuit totaliter combusta."

The surface of the lava-fields of Iceland present anything but a uniform appearance. Some are very uneven, consisting of innumerable fragments of lava and scoriæ, porous, brittle, and with a clear metal-

CLIFFS AT THE COAST OF SKAGI (TUFF AND BRECCIA).

lic ring, the separate mounds of lava being heaped together in the most extraordinary fashion. These lava-streams, which the Icelanders call *apalhraun*, are relatively narrow with high edges, looking, when viewed from a distance, like fences or ridges on flat land. A lava-current of this description is very difficult to cross. The fragments of lava are so loosely stacked together that the least touch disturbs their equilibrium. Another variety of surface, called *helluhraun*, consists of immense sheets of lava. This is the characteristic form of the largest lava-fields. Sometimes they are quite level, but more frequently they are broken and cracked in numerous directions. Innumerable twisted and tangled "ropes" of lava undulate in long curves up and down the wave-like surface of the viscous lava. Most of the lava-fields

of this class have originally been level, but upon cooling down they have cracked and ruptured, and large sections of them have subsided; so that the surface has thus become uneven and diversified by innumerable small ridges, mounds, circular depressions, and thousands of cracks or crevices. At the side of the large lava-cones there frequently exists a lumpy variety of laminated lava, its surface being, as it were, blistered and crumpled into serpentine knots and furrows all as smooth as hardened pitch. In these laminated lavas there are an immense number of rifts and tunnels. Sometimes the liquid lava underneath has flowed away, leaving hollow spaces beneath the level crust, the which spaces are often long and circular, like gigantic drain-pipes. The largest and best known is Surtshellir, 1762 yards long. Their interior surface is frequently glazed, and a sort of "stalactite" of divers different shapes hangs down from the top. Sometimes the hollow formation and the laminated formation are united in the same lava-current. The upper part, plunging down a steep incline, may be broken and uneven, but upon reaching the flat ground below, it spreads out into a lava-lake with level sheets of lava on the surface. Those lava-fields which lie far above the level of the sea are almost entirely destitute of vegetation; but down on the lowland plains nearer the coast, the older lavas are frequently sprinkled with humus, on which grass, heaths, and scrub manage to subsist. Notwithstanding the plenteous fall of rain and snow, there is scarcely any water to be found in the lava-wastes. The water percolates through the porous lava, and generally gushes up in clear springs along the margins of the deserts, in such number that they often give origin to streams of considerable volume.

Most of the large lava-fields were formed during eruptions in prehistoric times. The quantity of lava that is ejected varies greatly in different eruptions. Some of the outbreaks within historic times have yielded an inconsiderable quantity. But as a rule the lavas which issue during volcanic eruptions in Iceland cover vast areas; indeed, they sometimes stretch over wide districts, like the lava-field of Laki, one of the largest in Iceland, seeing that it hides some 220 square miles of the island's surface. All the same, the ordinary eruptions seldom vomit forth more lava than suffices to cover about 12 to 15 square miles. On the other hand, the lava-currents frequently run to a great length. That of Laki, for instance, is 47 miles long. Another current, which issued before the dawn of history from Trölladyngja, in Odádahraun, is about 70 miles long; and yet another, which flowed from the craters at Fiskivötn, is nearly 90 miles long. These lava-currents have next to no fall. For instance, that from Trölladyngja has an average slope of 0° 41′, and for some 14 miles the lava-sheet lying north of Dyngjufjöll falls at an angle of not more than 0° 20′ 38″. There are, indeed, cases where the torrent, shortly after its emergence, has forced itself upwards over a slightly inclined plane. On March 12,

1875, one of the branches of Sveinagjá worked its way 620 yards up an incline of 0° 25′ at the rate of 35 feet in the hour.

Lava-falls down steep slopes, as much as 30° and over, occur in many places. The highest "petrified" lava-fall is a fourfold one—four curtains hanging one beside the other, 820 feet high, at Selvogur. It must indeed have been a magnificent spectacle to witness the stream of red-hot lava pouring down such a lofty escarpment. In all probability two of the four curtains came into existence during an eruption which took place in 1390.

Groups of secondary craters (*hornitos*) are pretty common on the vast lava-fields. Numbers of them are often clustered together on a relatively

AN ERRATIC BLOCK NEAR EGILSSTADIR, FLJOTSDALSHJERAD, EAST ICELAND.

limited area. No law can be discerned governing their mutual positions with regard to one another; contrary to what is the case with the larger eruptive craters, which always follow the fundamental lines of cleavage in the crust of the Earth, these *hornitos* are mostly associated with lavas which have flowed over marshy ground or filled up a lake or fjord. Beyond question, the largest group exists at Landbrot, in the south of the island, where hundreds upon hundreds of cones of scoriæ are crowded together upon the surface of a deep and ancient lava-current, measuring some 40 square miles. At Lækjarbotnar, near Reykjavik, there are several small hornitos, which resemble glazed kettles, made of thin laminæ of lava cemented together by the same material.

Large quantities of salt, especially sal ammoniac, are often deposited on the lava-torrents during eruptions in Iceland. This happened when Hekla was in activity in 1845, and Sveinagjá in 1875. The ancient records of the island tell how, after an eruption of Hekla in 1341, the lava-torrents were strewn with such enormous quantities of salt and sulphur that many horse-loads could easily have been gathered off them.

The quantity of ashes which has been ejected within historic times is nothing like equal in volume to the quantity of lava, and yet at times the showers of ashes have been anything but small. For instance, when the craters in the chain of Laki were in eruption in 1783, they vomited forth a mass of ashes and scoriæ equal to nearly one cubic mile, whilst the lava ejected was equivalent to a mass measuring some 3 cubic miles. The column of ashes on Hekla was measured on April 21, 1766, and was found to rise 16,500 feet above the summit of the mountain; on February 5, 1846, it overtopped it by 14,350 feet. During the eruption of the same mountain in the year 1510, a man in Skalholt, 28 miles distant, was killed by a "volcanic bomb;" and again on April 5, 1766, a fragment of basaltic scoriæ as big as a man's fist was hurled all the way to Vidivellir, a distance of not less than 103 miles. The finer ashes are carried to immense distances. When Mount Katla was in activity in 1625, the ashes fell at Bergen, in Norway; and when Mount Askja was in eruption on March 29, 1875, the pumice ashes were carried right across the sea to the west coast of Norway in eleven hours forty minutes, and in another ten hours they travelled as far as Stockholm. It is an awful visitation when clouds of volcanic ashes pass over the inhabited districts lying nearest to the scene of an outbreak. The pastures are smothered, the home fields and meadows ruined, the sheep and cattle die by scores from want of food and sickness, the latter caused by their eating the volcanic sand with which the scanty remnants of grass are mixed.

After an eruption the sheep are nearly always seized by a sickness, which the Icelanders call *gaddur*. Their molar teeth grow up into high sharp points, which lacerate the gums and the palate, setting up inflammation and causing deep sores, so that the sheep have to be killed. In the winter which followed the terrible eruption of 1783, there died in Iceland 53 per cent. of the cattle, 82 per cent. of the sheep, and 77 per cent. of the horses. Then came a famine, which carried off 9200 persons, or about one-fifth of the total population.

The Icelandic volcanoes often eject a large quantity of vitreous threads, sometimes as much as a yard in length. In appearance they resemble grey horsehair, and are analogous in character to the "Pele's hair" of the Sandwich islands. The ashes from the eruption of 1783 were so acid that they burnt holes in the burdock leaves, and left black patches on the sheep's skins, and the sheep's hoofs turned yellow when they walked amongst them. After the eruption sunsets of extraordinary vividness and intensity of colouring were observed, not only in Iceland,

but also in several parts of Europe; and in the former there were many unusual phenomena noticeable in the sky.

Earthquake shocks are also very common in Iceland, more particularly in the central parts amongst the volcanoes. But in the north-west peninsula and in the east of the island seismic disturbances are extremely rare. Closer investigation has proved that most of the earthquake shocks which occur in Iceland are "tectonic" in their nature; that is to say, they take place along the fundamental lines of faultage in the Earth's crust, and they are chiefly confined to three districts, namely, the vicinity of Húsavik in the north of the island, around the bay of Faxaflói in the west, and in the southern lowlands, where they have repeatedly occasioned serious loss of life and property.* On the north coast the volcanic region advances close to the sea, between the two great inlets of the Arctic ocean, Skjálfandi and Axarfjord. Around the shores of both there exist several ancient lava-currents of very considerable dimensions, and in many places the ground is cleft by a number of long and deep rifts. Even at the present day earthquake disturbances are very common in these districts, and often occasion much damage. The last serious earthquake took place beside Axarfjord on January 25, 1885. Great chasms were rent in the earth; huge fragments of rock were loosened from the mountain-sides; farmsteads were hurled down; the sand down on the flat stretches of the shore was whirled up into columns 300 or more feet high; and many crater-like holes were scooped out, measuring from 300 to 450 feet in circumference.† At Faxaflói earth-tremors are very frequent, but seldom cause any damage; they seem to be confined to the semicircular belt of faultings which almost surround the bay.‡

But the part of Iceland which has suffered most from devastating earthquakes is the southern lowlands. That region is fenced in by a ring of steep mountains, and along the line of fracture, where the mountains touch the plains, disturbances and subsidences of the ground are of frequent occurrence, giving rise to serious oscillations of the earth. In this region the earthquake disturbances do not proceed from any recognizable central point, but several sections of the Earth's crust are shaken with startling suddenness one after the other. Very often the seismic movement travels from east to west, beginning at Rangárvellir, one of the eastern parishes of the lowland plains, and stopping at Œlfus, the parish lying farthest west. Sometimes the entire distance is travelled by the successive shocks in only a couple of days; at

* I have printed a general history of earthquake disturbances in Iceland in the Icelandic periodical, *Andvari*, viii. pp. 53–107.

† My description of this earthquake was published in *Mitteilungen d. k.-k. Geogr. Gesellsch. in Wien*, 1891, pp. 272–273; and in *Geogr. Tidskr.*, xiii. p. 115.

‡ See *Geologiske Iagttagelser paa Snæfellsnes og i Omegnen af Faxebugten*, an appendix to the *K. Svenska Vetenskaps Akademiens Handlingar*, vol. xvii. pt. ii. No. 2, pp. 57–60.

other times months, and even years, elapse between the upheaval or subsidence of the several sections of the ground. Whilst these districts are in a state of earthquake disturbance, Hekla and the adjacent volcanoes seldom start into activity. Whenever Hekla is in eruption, each outbreak is invariably accompanied by weaker or stronger earthquake movements of the adjoining country; but the disturbances are of a different character from those I have just spoken of, and never at any time so violent.

During the whole of the thousand years or so that Iceland has been inhabited, the southern lowlands have always been much subject to earthquake visitations. In the last two or three centuries, the most violent and destructive earthquakes have been those of the years 1784 and 1896. The former completely ruined ninety-two peasants' homesteads; the latter was even more disastrous. The many hot springs which there are in this part of the island are constantly changing in consequence of the frequent seismic movements. New ones are unsealed, old ones stopped up. To the same active cause must be attributed the innumerable rifts in the earth, often extending to a length of several miles, as well as the subsidences of land and the alterations in the courses of the rivers.*

The best known of the hot springs are the Great Geysir and the smaller geysers associated with it. But, apart from these, there are hundreds of other hot alkaline springs scattered all over the country. All of them are closely dependent upon the fundamental structure of the island, and a careful study of their mutual relations gives many a useful hint towards elucidating the geological history of Iceland. They exist both singly and in large groups, and of all temperatures up to boiling-point. The commonest are those which are in a state of constant and regular ebullition. The more powerful geysers are rarer. During the earthquake of 1896 a new hot spring burst out at Reykholt in the Biskupstungur, and shot out columns of hot water to a height of more than 30 feet; and its activity still continues. On the same occasion, a natural fountain was formed 50 feet long by 23 wide, from which there issued showers of steam and hot water, shooting up to a height of about 800 feet. But shortly afterwards the upgush ceased, and in July, 1897, the temperature of the water did not exceed 162° Fahr. The widely known geyser of Strokkur, which was started by an earthquake in 1789, ceased its activity during the shocks of 1896, and at the present time its temperature is only about 158° Fahr. During my journeys through the island I have examined nearly every known hot spring, taken the temperature of the water, and drawn plans of some of the more important groups, so that in future it will be easier

* "Jordskjælv i Islands sydlige Lavland," in *Geogr. Tidskr.*, xiv.

to ascertain what changes they undergo.* Carbonic acid springs (*ölkeldur*) are found in a few places, but more particularly on Snæfellsnes. On the other hand, solfataras and pits of boiling mud (*maccalubas*) are very common in the volcanic regions where tuff is the predominating rock. The solfataras at Krisuvik and Mývatn are very well known. I also discovered (1888) solfataras of grand proportions and with marked peculiarities in the liparite mountains of Kerlingarfjöll near Arnarfellsjökull. Smaller sulphur springs exist in several other places, more especially on the peninsula of Reykjanes.

Herewith my brief survey of the geography and geology of Iceland must come to an end. I am painfully conscious of its imperfections; but if I have in this way made it easier for those, who take an interest in the physical phenomena of my native island, to find the sources for the more recent discoveries that have been made, I shall not have written altogether in vain. May I conclude with the wish that on some future occasion I may have the privilege of describing for English readers at greater length some of the more remarkable of the many remarkable physical phenomena which Iceland is able to offer for scientific study?

THE EASTERN GATEWAY OF THE UNITED STATES.

By Prof. A. P. BRIGHAM, Colgate University, U.S.A.

The mountain barrier of eastern North America stretches from Central Alabama, north-easterly through Labrador. The vast lowlands of the Mississippi valley and the great plains of Canada lie on the west, and the Atlantic ocean, with a rim of coastal lowlands, on the east. The mountains are nowhere lofty as compared with the high mountains of the globe, but they are often rugged, and in the universally forested condition of the early days formed a barrier nearly impassable to human intercourse. The system is made up of elements diverse in age and character. Oldest of all are the Adirondacks of Northern New York, and the so-called Appalachian protaxis of Dana. The latter consists of the highlands of the Hudson, the uplands of New Jersey, South mountain in Pennsylvania, and the Blue Ridge of the Southern states. Extending southward through New England, not far eastward from the Adirondacks are the next oldest mountains of the system, the Green mountains of Vermont, extending south through Massachusetts and Connecticut. They fall in between Ordovician and Silurian time. The newest part of the system is the Appalachian range proper, a great series of folds in

* I have published a separate account of the remarkable group of springs at Hveravellir, near Langjökull, on the plateau, "De varme Kilder paa Hveravellir i Island," in *Ymer* (Stockholm, 1889), pp. 49-59, with a map. I have also published, in *Geogr. Tidskr.*, xii. p. 223, a map of the hot springs at Torfajökull.

Palæozoic strata, extending from Alabama to Catskill, New York, a point about 120 miles north of New York, on the Hudson river.

By successive deformations, nature seems thus to have walled in the sea-shore from the great heart of the continent. Two gateways, however, lie open. One of these is the St. Lawrence valley, cut along the pre-Palæozoic contact and across Palæozoic beds to the gulf which bears the same name. But with this gateway this paper has little to do. We go several hundred miles to the south, enter New York harbour, and sail up the tidal course of the Hudson. Soon after leaving New York we traverse the trench cut through the ancient highlands. Then we have on the east the Green mountain range, and on the west the low northern terminus of the Appalachian folds. A few miles farther west, and rising far higher, is the great easterly facing escarpment of the so-called Catskill mountains—really the north-eastern terminus of a plateau lying west of the mountain folds from Alabama to Eastern New York.

Leaving tide water at Albany, we rise over a stretch of nearly 20 miles of barren glacial sands to Schenectady, where we find an open road leading to the west. This is the Mohawk valley, the eastern gateway of the country. Northward, or on our right as we go west, rise the rugged foothills of the Adirondack mountains. Southward, on our left, are seen the bold escarpments of the Helderberg mountains, which are really the steep slope by which the long plateau drops off to low ground at its northern end.

To understand the physical history of the Mohawk valley, it will now be desirable to review briefly the geology of the region. New York is classic ground in American geology, and the subject may be touched briefly and dismissed. The outcrops of the older Palæozoic rocks run around the Adirondack nucleus, and border the pre-Palæozoic of Canada on the south. Thus the Trenton limestone, Utica shale, and Hudson river shales and sandstones extend in nearly east and west belts, south of the Adirondacks, dipping slightly southward. The Mohawk valley is cut along the strike of the Utica-Hudson shales (Ordovician) as far north as the south projecting spurs of the Adirondacks would allow. In like manner, only extending further west, we find east and west outcrops of the several Silurian and Devonian formations, until the middle and upper Devonian beds cap the plateau at heights of 2000 to 4000 feet in the Catskills, and 2000 feet or a little less farther west. The northern edges of these formations abut against the Mohawk valley, or, it would be better to say, the valley has been cut into their beds, which once stretched farther north, covering the now exposed lower flanks of the Adirondacks.

Before outlining the history of the valley, let us look more narrowly at its character. We have to do with a trench about 90 miles long, from Rome to Schenectady. Easterly it opens into the broad Hudson lowlands; westerly it widens into the lacustrine plains of Iroquois, the larger glacial antecedent of Lake Ontario. Once pass the gateway at Rome

and the path is clear, over the lake plains and prairies to the far west. Seen from the railway as we pass, the valley appears to be a trench about 500 feet deep, with moderately steep sides, and with an average width of river and flood plain of about one half-mile. Seen more truly from the bordering uplands, it is a vast gap, 1500 to 2000 feet deep, several miles wide in its higher parts, lying between the Catskill plateau and the Adirondack mountains. The altitudes are shown in the following table:—

Hudson at Albany	Tidewater
Sand-plains, Schenectady	340 feet
Schenectady	246 „
Amsterdam	279 „
Little Falls	376 „
Utica	410 „
Rome	445 „

From Utica to Syracuse, 53 miles, the Erie canal traverses a single level. From Syracuse to Rochester, 81 miles, the uniformity is nearly as noteworthy. From Rochester to Buffalo, a gentle swell is passed at Batavia at a little above 800 feet. This is, by this route, the highest point between New York and Chicago, or between New York and points far beyond the Mississippi river.

It shall be our aim to see now, first, how the valley was made—in other words, to follow the lines of its physical history; and, second, to see of what importance this gateway has been in the historical development of the empire state, and of the entire country.

We recur to the general fact concerning the geology of the states bordering the Laurentian lakes on the south, namely, that the Palæozoic beds, from the Cambrian to the summit of the Devonian, dip very gently southward from the pre-Palæozoic terranes of Canada and the Adirondacks. Their strikes may be said to represent the position of an old shore-line that was receding southward by the processes of deposition and uplift. The ancient streams must have had their sources on the northern crystalline highlands, have crossed the growing belt of Palæozoic lands, and emptied their waters into the interior sea then covering the coal-areas of Pennsylvania and other states. At an undetermined, but early time, the great St. Lawrence valley, including that of the lakes, was formed, approximately along the northern border of the Palæozoic, but swinging northward of the pre-Palæozoic Adirondack mass. Thus a great body of waters coming from the north was diverted to the east.

The majority of American physiographers who have given attention to the subject, believe that the entire Appalachian belt, from Southern New England nearly to the Gulf of Mexico, was in Cretaceous time reduced to a pene-plain, or nearly to base-level, and that in Tertiary time this body of land was elevated, with warping, to plateau levels of

one to several thousand feet. The New York part of the plateau was lifted from 2000 to 3000 feet. During this uplift, it is believed that the valley of the Hudson was in process of excavation. The St. Lawrence was probably earlier in origin. But the streams from the southern Adirondacks were still discharging across central and southern New York, and reaching the sea through an ancient Susquehanna river. The map will show the alignment of these Adirondack waters with the headwaters of the present Susquehanna.

Given now a growing Hudson valley, and outcrops of the soft Utica and Hudson river shales along the southern base of the Adirondack mountains, it was inevitable that a river valley should be excavated along this line from near Albany westward. The headwaters of the young Mohawk ate back into the country to the west, diverting the Adirondack waters to the eastward, and beheading the south-flowing streams of the plateau of Central New York. This headwater cutting proceeded as far as Little Falls, where it was stopped by a barrier of the ancient gneisses, which in very ancient times was faulted up across the line where the valley was later to run. By a process entirely similar, a valley headed back to the east from the ancient St. Lawrence, diverting thither the streams of the south-western Adirondacks, and beheading other Susquehanna head-streams. The col remained at Little Falls until the close of glacial time. Then great discharges of water were sent across the col to the ocean, by way of the Mohawk and Hudson. This resulted in reducing the height of the col by a considerable measure. A further effect of the glacial waters was to aggrade the valley between Little Falls and Rome to such a degree that the divide was transferred from the former to the latter point.

The glacial history of the valley has proved of such large interest in American pleistocene geology as to warrant a further sketch of it. No chapter in our glacial studies has had a more dramatic interest than the formation in the Laurentian and Red river basins of vast glacial lakes, lying, as most believe, between the divide on the south, and glacial dams formed by the retreating ice-front on the north-east. Lake Agassiz has been worked out by Mr. Warren Upham, under the auspices of the Canadian and United States Surveys. Mr. G. K. Gilbert, Dr. J. W. Spencer, Mr. F. B. Taylor, and others, have studied the Laurentian glacial lakes. One of the greatest of these was Lake Warren, stretching from New York far westward, and discharging into the Mississippi basin. The shore-lines of this lake have an altitude of 870 feet in Western New York. Later the Mohawk valley was freed from ice and the discharge turned to the eastward. Prof. H. L. Fairchild has traced for some distance in Western New York the beach of another great lake, at an altitude of 700 feet. Studies by the writer point to another water-level at about 600 feet, with discharge through the Mohawk valley. The principal evidence of this is found in a number of great deltas and

delta-like terraces built into the valley at the mouths of lateral streams, from above Rome to Little Falls. Striking evidences of eastward-flowing

PART OF NEW YORK STATE.

waters have been studied by Mr. Gilbert and others, south of Syracuse, N.Y., where cross-channels dissect the spurs of the plateau, and great

amphitheatres, cut to depths of 200 feet in the limestone, show the presence, in closing glacial times, of cataracts almost rivalling Niagara.

The Mohawk valley had thus had a long and intricate physical history. Largely cut out in Tertiary days, it remained for the events of the Ice Age to give it a great accession to its headwaters, and to remodel its topography by glacial erosion and accumulations. We are now prepared to study the valley in its relation to man. This record goes back but about three hundred years, but, brief as it is, it has been deeply significant in American history. While holding heartily that geography is the study of the Earth as the environment of man, it is a doctrine equally sure in the mind of the writer, that a knowledge of the origin of geographical forms must accompany historical and sociological study. The military and commercial significance of the Mohawk valley cannot be fully appreciated until seen against the background of the millions of years of physiographic development.

The first European explorers and settlers in the region now known as the state of New York, found established there several powerful Indian tribes, known as the Confederacy of the Five Nations. They occupied the region which extends from the Mohawk valley eastward. Northward is Lake Ontario, westward are the Genesee country and Niagara, and on the south lies the fine series of Finger lakes. It is a country moderately diversified, highly fertile, and is now one of the garden spots of the United States. This was the famous "Long House" of the Five Nations. The Mohawks were the most easterly of the tribes, and they called their fair valley the eastern gateway of the Long House, and they were its keepers. These tribes were in a comparatively advanced state. They practised agriculture extensively, lived in neat and comfortable cabins, possessed considerable industrial skill, were eloquent in public counsel, and were the objects of widespread fear through their prowess in war.

With these sturdy aborigines the European immigrants found themselves in alliance or at war. One avenue of approach was by ascent of the Hudson river. A second was through the Champlain valley from the St. Lawrence. A third lay along the eastern shore of Lake Ontario by the site of Oswego. Thus from the first the rippling waters and bordering flood plains of the Mohawk were a beaten path, frequented by French, Dutch, and English in various contact of war and peace with the natives of the land.

Of these the French were the first to invade the Mohawk country. Not far away, at Ticonderoga, Champlain, the first white actor on this stage, had aided the Hurons against the Five Nations, and had thus, by the enmity aroused, determined for the English the ultimate control of the region. A later invasion was made by the French along the shore of Lake Ontario, but they were defeated and forced to retire. There were peaceful invasions, also, for in the valley captive missionaries

endured torture and sometimes death. Most heroic and famous of these is Father Jogue, whose fate has recently been commemorated by a shrine of his church, erected where he perished, on the edge of a glacial terrace south of the river. The final failure of the French to dislodge or convert the natives of the valley was fraught with weighty results in the history of the new continent. Had they won this great highway, they might in later years have maintained themselves on the St. Lawrence, and have held the keys of the new world.

It was the Hudson-Mohawk valley which early guided the Dutch in their effort to carve a slice from the new continent. Under an English commander, Hendrick Hudson, they sailed up the river which bears his name. Coming to the limit of navigation, they built Fort Nassau, below the site of Albany, and concluded a treaty with the Mohawk Indians. Its object was trade, and it went far to prevent French control of the valley. They built Fort Orange in 1622, and thus laid the foundations of Albany. In 1642 Arendt van Curler entered the Mohawk country, reported its lands as "the most beautiful that eye ever saw," and was later authorized to buy the "great flats" where Schenectady now stands. The old town and family names of the lower Mohawk still bear proud testimony to this wave of immigration, in the ever-present Fondas, Schuylers, Sprakers, Sammonses, Van der Veers, and Yosts of the river country.

The first white settlement in the upper stretches of the valley was made by the Palatines in 1723. Following the devastating wars of Louis XIV., thousands of these stricken people left their homes on the Rhine and took refuge in England. Some of these were sent to America, under a compact to reimburse the English Government for their passage, and for the allotment of lands. After a period of great suffering, first on the Hudson and then on the lower Mohawk, a final removal brought them to the German Flats Patent, between Little Falls and Utica. Here each family received a liberal allowance of the rich alluvium and adjacent uplands of the valley, and their descendants have been powerful in the history of the state and nation.

The next wave of immigration which swept up the valley was English. In 1784, Hugh White passed the Hollanders of Schenectady and the High Dutch of German Flats, and founded Whitestown on the upper river. His coming was the signal for a lively movement from the stony slopes of New England to the inviting fields of the Long House, to which the Mohawk was the only road. Then came the stream of emigrant waggons bearing the names of Ohio and Indiana, regions which were then the far distant West.

This stream of travel has never ceased to flow, but has rather augmented a thousand times in the century which has passed. Before considering the Mohawk valley as a highway, however, it will be well to observe that it was the theatre of important military events in

colonial times. English forts had been erected on the upper Hudson by the year 1709, and before the year 1712 the chain had been extended up the Mohawk to Fort Hunter, 40 miles from Albany. In 1720, through the influence of William Burnet, son of Bishop Burnet, and Governor of New York, forts were built at Oswego and farther west at Irondequoit bay. About the time of the French war a number were built near the present city of Rome, or in the vicinity of the Oneida carrying-place. "These and similar efforts on the part of the English served to divert from the French into English channels a large Indian trade, and to make the route *viâ* Mohawk river and Oneida lake the shorter one between Albany and Canada, the one most generally travelled." The Mohawk and Champlain became thus great highways trodden by hostile forces in the French and Indian wars, until the French rule came to its end in Canada in 1760. Local histories are filled with exciting records of midnight attack, weary marches in captivity, and all the terrors of border warfare. Here, too, was fought one of the less-known but most critical battles in the struggle between the colonies and the mother-country, the battle of Oriskany. On the south slope of the valley, a few miles west of Utica, the Dutch farmers rallied under Nicholas Herkimer, and defeated the English and the Indians, who would otherwise have gone down the valley and supported Burgoyne in his campaign on the Hudson. The combatants on each side numbered but a few hundreds, but the result is thought by many to have been decisive of the main issue of the war. Since that day the history of the valley has been an unbroken story of peace, and to this we now turn, to consider one of the best illustrations of physiographic control over the movements of man which the New World can supply.

In the pioneer days the Mohawk was considered a navigable stream, and immigrants and freight were conveyed over its waters in boats propelled by poles. Severals breaks were, however, necessary—a first beyond Albany, because of the abrupt fall of 70 feet at Cohoes; a second at Little Falls on account of impassable rapids over the gneissic barrier which the stream there encounters; and a third of 2 miles at the Oneida carrying-place, where the Mohawk is left to the east, and the winding course of Wood creek is followed to Oneida lake. Early legislative authority was given for improving navigation at these points, and soon after 1791 a canal 3 miles long with five locks was constructed at Little Falls, and a further canal conducted boats across the Oneida carrying-place. We read that then enlarged boats with five men could transport, between the terminal points of navigation on the river, twelve tons in ten days. Long lines of waggons and stages also traversed the bottom lands, making the valley a busy highway between the east and the expanding west.

A continuous waterway from the tidal waters of the Hudson to the

blue expanse of the Laurentian lakes became now the subject of serious discussion. Enough of the geography was known to suggest the possibility of such communication, but the following order issued to a commander on Lake Ontario in 1814 shows also the extent of the ignorance that prevailed. "Take the *Lady of the Lake* and proceed to Onondaga, and take in at Nicholas Mickle's furnace a load of ball and shot, and proceed at once to Buffalo." "That means," said the perplexed officer, "that I am to go over Oswego falls and up the river to Onondaga lake, thence 10 miles into the country by land to the furnace, and, returning to Oswego, proceed to the Niagara and up and over Niagara falls to Buffalo."

The demand for a water-route was strengthened by the danger that the growing commerce of the Genesee country would be diverted either down the St. Lawrence to Montreal and Quebec, or by the Susquehanna to Philadelphia. It is difficult to assign credit for the first suggestion of an Erie canal. Probably the idea was conceived independently in several thoughtful minds. Such a prediction is said to have been made by Captain Joseph Carver in 1776. Elkanah Watson, describing a westward journey in 1788, voiced his "strong presentment that a canal communication will be opened sooner or later from the Great Lakes to the Hudson." Governeur Morris is reported to have said in 1803, "Lake Erie must be tapped, and the waters carried across the country to the Hudson." He thought there should be a uniform declivity between the two, not taking account of the height of land in Western New York. The legislature took up the matter in 1808, a survey was made, and in 1810 a commission was appointed. The project then fell into abeyance, until revived by De Witt Clinton in 1817. Navigation was finally opened between Lake Erie and the Hudson on October 26, 1825. The price of transportation from Albany to Buffalo, about 300 miles, gradually declined during the twenty-six years after the opening of the canal, from $88 to $5.98 per ton. Later, railway competition became effective, and transportation from Buffalo to New York in 1885 was but $1.57 per ton. Of the vicinity of Rochester, it is said, upon completion of the canal, that her timber found market and floated away, wheat quadrupled in price, the mud dried up, the mosquitoes, the ague and fever, and the bears left the country, and prosperity came in on every hand. In like manner, the salt, gypsum, lime, and grain of Onondaga, where is now the great city of Syracuse, found ready market. But it is not enough to cite these comparatively local results. The meaning of the Mohawk valley is that the entire region of the Great Lakes, and the vast prairie and mountain regions of the West, became tributary to the rising metropolis on Manhattan island. Hence it is that New York, rather than Boston or Philadelphia, or Baltimore, is the metropolis of the Western Hemisphere.

A similar story has now to be told of railway communication through

this valley. There was no railroad in America prior to 1826. In that year a horse-railway 4 miles long was built at Quincy, Mass., for the transportation of granites from the quarries. In the same year the legislature of the state of New York granted a charter to the Mohawk and Hudson River Railway Company to build a road from Albany, on the Hudson, to Schenectady, on the Mohawk, a distance of 18 miles. This was the first chartered railroad in America. It was completed October 31, 1826, and at once carried four hundred passengers daily. This, it will be remembered, was soon after through traffic began on the Erie canal. In 1833 a charter was granted for a road to extend from Schenectady up the river to Utica, a distance of nearly 80 miles. This division was in running order in 1836. A further link in the westward series between Syracuse and Auburn was finished in 1837, and from Utica to Syracuse in 1839. A curious argument was urged for a break in the chain of roads at Utica, namely, that otherwise it would become a mere way station on a great line, and its business would fail to develop. The discussion shows that the consolidation of the future was forecast at an early time. Gradually the line was completed from New York to Buffalo, 450 miles, and became known as the New York Central and Hudson River railway, or more commonly as the New York Central, one of the greatest railways of the world. Four tracks lie side by side from Albany to Buffalo, two being used for passenger traffic, and two for the conveyance of freight. Owing to the abrupt descent of the valley slopes to the river, but two tracks lead from Albany down to New York. The seaboard terminal is New York with its three millions of people, and an adjacent suburban population in New Jersey of more than a million. At the western terminal is Buffalo, the eastern goal of lake navigation, with nearly four hundred thousand people. On the line are Rochester, Syracuse, Utica, and Albany, nearly a score of smaller cities and innumerable busy towns. A great number of minor railways pour their tribute into this great artery of transportation, and it is hardly true to call Buffalo a terminal point, since many solid trains each day push on without change both south of the lakes and across Niagara, through the dominions of Her Majesty the Queen, 500 miles further, to Chicago. There is not a difficult grade or an embankment or trestle of any importance between New York and Buffalo, and with slight exception this holds good from Buffalo to the Rocky mountains. Two thousand miles of splendid country are thus made tributary to the harbour of New York through the river gateway which we have described. About twenty years ago a competing line with two tracks was constructed, and called the West Shore railway. It extends up the Hudson on the west side, along the Mohawk on the south side, and thence closely parallel to the Central railway to Buffalo. For the most part the same towns are served by the two lines, and the newer has now become an integral part of the older system, so that the

New York Central virtually crosses the empire state with a line of six parallel tracks. It should be added that the second telegraph line in America joined Albany and Utica along the Mohawk valley, being finished on January 31, 1846. A short line between Baltimore and Washington preceded it by two years.

To sum up, the valley is now threaded by the ancient highways, the Erie canal, six railway tracks, and innumerable telegraphs and long-distance telephones, by which New York converses with Detroit, Indianapolis, Chicago, and other western cities. The passing up and down —day and night—of men, of thoughts, of commodities, is like the ebb and flow of tidal waves whose course is only stayed as traffic rests on the docks of Europe and of more distant continents.

But it must not be thought the Mohawk is the only road which has been sought out to the West. It is only a broader gate with a lower threshold. There are other great railways, but none of them passes the Appalachian belt at an altitude of 445 feet. A brief comparison will be instructive. Take first the roads which traverse the empire state from the seaboard. Much English capital was vested in the Erie railway. Perhaps the flow of money would have been less free had its sinuosity and heavy grades been known. At 75 miles from New York it must attain a height of 870 feet to pass the Kittatinny mountains. At Port Jervis the altitude is 442 feet; at Deposit, 1008 feet; near Elmira, 799 feet; and at Castile, 1401 feet, with some large embankments and difficult bridges. Likewise the New York, Ontario, and Western railway, running to Oswego and the west, crosses difficult divides, and rises and falls between low altitudes and maxima of nearly 1800 feet. The Delaware, Lackawanna, and Western railway rises to 1932 feet at Tobyhanna Pa, and in 27 miles descends to 745 feet at Scranton. Thence it passes into New York, where it varies between 846 feet and 1359 feet.

Of the roads which cross the Appalachians south of New York, the conditions are similar. The Lehigh Valley road from Philadelphia maintains a course below 700 feet for 100 miles; then in 30 miles climbs to its summit, 1728 feet; and in 20 miles more drops to 549 feet at Wilkesbarre. The Pennsylvania, one of the finest roads in America, is obliged to make at one point an altitude of 2161 feet, and has one section of 5 miles whose grade is 80 feet per mile. The Baltimore and Ohio road, still farther to the south, has its summit at 2620 feet. Farther south the facts are yet more striking, and it is less than twenty years since a railway first crossed the southern Appalachians. The early hunters and settlers who entered Kentucky and Ohio from Virginia and the Carolinas, sought the high and difficult passes of the mountain and forest, crossing, so to speak, the grain of the country, while along the Mohawk the Dutch and English walked in as by an open door.

In conclusion, let us return to the winding waters and fertile flood-grounds of the Mohawk. After its sources leave the high hills of

Central New York, it follows from Rome to the Hudson, a short course of 110 miles. Upon its banks are six cities, all good illustrations of physiographical control. Rome, with 15,000 people, is built at the Oneida carrying-place; Utica, a thriving city of 60,000 souls, is determined by an old fording-place, and receives tribute from Central New York through a number of lateral valleys. Little Falls, a small but busy city, depends upon an ancient carrying-place and its water-power, the primal cause being an extensive fault which here crosses the river from north to south. Farther down is Amsterdam, a city of 20,000, and a great centre of knit goods and carpet manufacture. Schenectady, with 25,000 people, lies on the great flats, where the river issues from the uplands upon the old estuary ground of the Hudson, as it was in a time of continental depression. The last is Cohoes, a city of looms, whose superb water-power is due to the falls of the Mohawk, just before it enters the Hudson. The lower Mohawk was thrown out of its course by the events of glacial time, and discovered the ledge over which it descends. Nine towns of 2000 to 5000 population are also scattered along the river, with many smaller villages; while the stretches of alluvial field, backed by rising meadows and forests, offer scenes of greatest beauty.

The writer has seen the valley from every point of view, has lived in it, and gone up and down its course for many years, and scarcely knows whether to delight more in its physiographical history, its simple rural charm, or in the thronging life which marks it as one of the greatest highways of the world.

DELIMITATION OF THE BRITISH AND FRENCH SPHERES IN CENTRAL AFRICA.

By the agreement arrived at between Great Britain and France, the terms of which are embodied in the Declaration signed in London on March 21 last, one of the most thorny questions connected with the partition of Africa has at last received a satisfactory solution. Taken in conjunction with the Convention of June, 1898, to which it is regarded as an addition, the agreement completes the delimitation, in principle if not in detail, of the entire spheres of the two powers in Central and West Africa, and at the same time removes the last important area of debatable ground from the map of the whole continent.

The region lately in dispute forms, as it were, the central core of the African continent, on which the forces of civilization have been gradually converging from north, east, and west. As guardian of Egypt, and also in virtue of her protectorate on the headwaters of the Nile, Great Britain has since 1890, when the claim was first definitely made in the Anglo-German agreement of that year, sought to retain within

her sphere of influence the whole basin of the Nile, while France, in her forward march from the West Coast, has pursued the double object of gaining access to that river and of uniting into one homogeneous whole her entire territory from the Gabun to Algeria. The conflicting claims resulting from this state of things have, under the recent agreement, been settled by what is perhaps the most rational compromise under the circumstances. France has once for all renounced her claim to territory within the Nile basin, and in return obtains from Great Britain the formal recognition (given by implication only in the agreement of last year) of her suzerainty over Wadai—indispensable to her dream of a united empire from the Congo to the Mediterranean, though the land is still entirely untouched by European influence. In addition to the Bahr-el-Ghazal territory, the whole of Darfur falls to the British sphere, and Egypt thus secures all the ground occupied previously to the Mahdi's revolt, with the exception of some outlying districts, beyond the limits of the Nile basin, now included within the Congo State. The acceptance of a natural frontier such as the Nile-Congo water-parting is to be hailed with satisfaction in contrast to the arbitrary limits so often adopted in African delimitations.

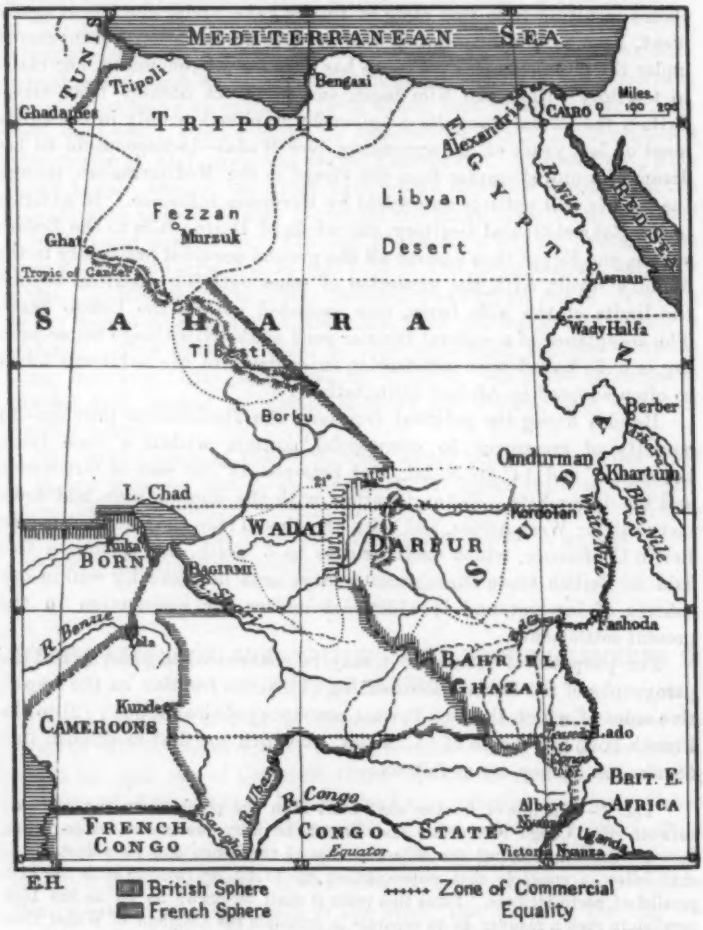
Besides fixing the political frontiers, the Declaration provides for equality of treatment in commercial matters within a zone lying between 5° and 14° 20′ N. lat., and between 14° 20′ east of Greenwich and the upper Nile. Taken together with the similar zone laid down last year for West Africa, and with the Free Trade zone defined by the Berlin Conference, which itself reaches to 5° north, this secures a free field to British trade throughout a large area not actually within our spheres of interest, and is additional matter for satisfaction in the present settlement.

For purposes of reference, it may be convenient to print in full the paragraphs of the Declaration relating (1) to the frontier on the respective sides of which the two Powers renounce political action; (2) to the French boundary north of 15° N. lat., at which the first-mentioned line terminates. They are as follows:—

"Par. 2.—The line of frontier shall start from the point where the boundary between the Congo Free State and French territory meets the water-parting between the watershed of the Nile and that of the Congo and its affluents. It shall follow in principle that water-parting up to its intersection with the 11th parallel of north latitude. From this point it shall be drawn as far as the 15th parallel, in such a manner as to separate in principle the kingdom of Wadai from what constituted in 1882 the province of Darfur; but it shall in no case be so drawn as to pass to the west beyond the 21st degree of longitude east of Greenwich (18° 40′ east of Paris), or to the east beyond the 23rd degree of longitude east of Greenwich (20° 40′ east of Paris).

"Par. 3.—It is understood, in principle, that to the north of the 15th parallel the French zone shall be limited to the north-east and east by a line which shall start from the intersection of the Tropic of Cancer with the 16th degree of longitude

east of Greenwich (13° 40′ east of Paris), shall run thence to the south-east until it meets the 24th degree of longitude east of Greenwich (21° 40′ east of Paris), and shall then follow the 24th degree until it meets, to the north of the 15th parallel of latitude, the frontier of Darfur as it shall eventually be fixed."



SKETCH-MAP ILLUSTRATING ANGLO-FRENCH AGREEMENTS OF 1898 AND 1899.

The accompanying sketch-map shows the lines here laid down, the former of which is to be the subject of delimitation on the spot by commissioners representing the two governments. The approximate western limits of Darfur are shown by a strong dotted line, while the extreme limits within which the frontier is to be drawn are also marked. With

reference to Par. 2, it may be observed that the Nile-Congo water-parting ceases at about 8° 30′ N., and that thence to 11° N. it is the Nile-Shari water-parting which, according to the spirit of the agreement, must be followed. The strict letter of the declaration would equally allow the adoption of the Congo-Shari water-parting between these latitudes. As regards Par. 3, it is to be noticed that, though Great Britain allows the claims of France to a large area of the Central Sahara north of 15°, including the mountainous country of Tibesti, she makes no claim herself to the territory on the other side of the line laid down, which therefore still remains outside any recognized sphere. As, however, it is occupied by the Libyan desert, perhaps the most inhospitable tract of the whole Sahara, it is little likely to become the object of acquisitiveness on the part of any Power. This is less the case with Tibesti, which, besides, naturally belongs to the *Hinterland* of Tripoli, and the present recognition of French claims will not, of course, be binding on other Powers. It is not quite clear whether the line laid down is intended to be drawn due south-east from its starting-point, for if so, it might possibly strike the frontier of Darfur before reaching the 24th meridian, which would then form no part of the French frontier.

It has been pointed out, in connection with the recent agreement, that the lease of the Bahr-el-Ghazal province to the Congo State in 1894 has never been cancelled by any agreement with this country, although by that with France in the same year the State undertook not to exercise any political influence north of 5° 30′ N. It is not to be expected, however, that this question will be opened by the State authorities, and it may be remarked that the chief concession made as a set-off to the lease has not been enjoyed by Great Britain, while other adjustments of frontiers in 1894 were mainly to the advantage of the State. Thus, whereas the 30th meridian formed the original eastern limit of the State in the direction of the Nile, the frontier was in 1894 advanced eastward so as to include the extreme corner of the Congo basin, without any corresponding rectification further south, where a portion of Lake Albert Edward and the Semliki valley fell to the State, although on natural grounds forming part of British East Africa.

In addition to the Libyan desert, the only portions of Africa not yet brought nominally under the influence of any European Power are the states of Abyssinia and Morocco, and it is in respect of these chiefly that future frontier difficulties may be expected. Should these states permanently maintain their independence, questions would still have to be settled between them and neighbouring Powers. The interior limits of French Somaliland are still undefined, while the exact frontier between Eritrea and Abyssinia has not yet been drawn, to say nothing of that between Abyssinia and the Anglo-Egyptian territory. Of other territorial points still unsettled, the chief are the Anglo-Portuguese

frontier on the upper Zambezi; the Anglo-German frontier behind the Gold Coast*; the Congo-German frontier north of Tanganyika†; the exact limits between French and Italian territory on the Red sea; and, lastly, the interior limits of the Spanish Sahara.

THE NEW TANGANYIKA EXPEDITION.

Mr. J. E. S. Moore, accompanied by Mr. Berridge and Mr. Arnold Matthews, two other members of the new expedition for the further exploration of Lake Tanganyika, left London on April 19 last for Zanzibar, where they will stop a short time to engage the services of the necessary carriers and other native attendants. When this is effected, they will go on to Chindi, where Mr. Fergusson, the surveyor and geologist of the expedition, will join them. The whole party will then proceed by the Zambezi and Lake Nyasa route to the south end of Lake Tanganyika, which they expect to reach some time in July. For the better exploration of Lake Tanganyika, it has been arranged to obtain from the African Lakes Company the use of their steamship, which is at present the only one on the lake, although we believe that a second steamer for Tanganyika is now being built, and will shortly be placed on that lake by the Tanganyika Exploration Syndicate.

Many months—it is not possible to say exactly how long—will be devoted to the exploration of Lake Tanganyika, its fishes, mollusks, and other products, both animal and vegetable, for which purpose Mr. Moore has taken with him a complete set of dredging apparatus, and all other modern appliances adapted to facilitate dredging and netting at considerable depths. It is hoped in this way that the knowledge of the strange fauna of Lake Tanganyika already acquired by Mr. Moore during his previous expedition, will be greatly supplemented. Meanwhile, Mr. Fergusson will devote himself to the examination of the geological structure of the ranges on both sides of Lake Tanganyika, and ascertain, as far as possible, what formations occur along its shores. Mr. Fergusson will also take observations for cartographical purposes, the expedition being well supplied with instruments by the Society.

After the necessary time has been devoted to Lake Tanganyika and its geological history, Mr. Moore and his party will proceed to the north end of the lake, and endeavour to make their way thence across country northwards to the south end of Lake Albert Edward. This piece of country, which is about 300 miles in extent, has never yet been crossed

* Apart from the question of the neutral zone, the White Volta has never been accepted by Great Britain as the German frontier north of 10° N.

† M. Wauters has maintained that the State frontiers have been completely defined by international agreements. But it is, we believe, the case that the map attached to the treaty with Germany in 1885 showed the boundary more to the west than other documents of about the same date, by which Germany might with reason refuse to be bound.

from south to north by any European party, and is of very great interest; it is believed to be part of the "Great Depression," which extends for an enormous distance from north to south through Central Africa. About halfway between the two great lakes is the small lake Kivu, which will require thorough examination in order to ascertain whether its fauna corresponds in any degree with that of Lake Tanganyika. Kivu was visited by Graf v. Götzen in 1893, during his adventurous journey across Africa from east to west, but few particulars regarding its physical structure, and none, we may say, about its living products, were obtained. The same ignorance prevails concerning the physical and faunal characters of Lake Albert Edward, which has, indeed, been hardly visited except by hasty passers-by. The Tanganyika explorers have, therefore, an ample field before them for discoveries in geography, as well as in natural history and geology.

On arriving at the south end of Lake Albert, Mr. Moore hopes to be able to arrange to be met by the boats of the Uganda Administration, which navigate that lake.

The members of the Tanganyika Exploration Committee are Prof. E. Ray Lankester, F.R.S. (chairman); Sir John Kirk, G.C.M.G.; Sir William Thiselton-Dyer, K.C.M.G.; Mr. P. L. Sclater, F.R.S.; and Mr. G. A. Boulanger, F.R.S. Besides the sum of £600 granted to the Tanganyika Exploration Committee by the Geographical Society, Mr. Alfred Beit has made a generous donation of £1000, and two other gentlemen, who do not wish their names to be published, of £500 each; while Mr. Berridge, one of the members of the expedition himself, contributes £1500, and other smaller sums have been received. The expedition is expected to be absent two years, or nearly so.

THE MONTHLY RECORD.

THE SOCIETY.

The National Antarctic Expedition.—At the meeting of the Society on April 24, the President announced that H.R.H. the Prince of Wales had graciously consented to become Patron, and H.R.H. the Duke of York Vice-Patron, of the National Antarctic Expedition.

EUROPE.

Scenery and Vegetation of the Mountains of Bukovina.—An interesting paper on this subject appears in *Globus* (vol. lxxiv. No. 24) from the pen of Baron von Hormuzaki, who had previously treated of the broad climatic, faunal, and floral regions into which Bukovina may be divided. Bukovina is a land of surprising contrasts, arising both from the varying nature of its physical characters and from the unequal distribution of man's activity, all gradations being seen from the most intensive cultivation to the untrodden primeval forest. Of the whole surface, 44·59 per cent. is covered with wood, while in the mountains the proportion mounts to 60 or even 80 per cent. Of the wooded area, again, 75 per cent. is occupied by conifers (especially the spruce fir), while only 16 or 17 per cent. falls

to beech woods, so that the name of the province ("land of beeches") is by no means strictly applicable. The zone of the Carpathian sandstone, which is the first reached from the lowlands, is marked by great uniformity, and the wooded, humus-covered ridges have so slight an angle of slope that their summits are generally invisible from the valleys. Even in the higher mountains this type is prevalent, except in the limestone ranges and the highest parts of the primitive formation. Great contrasts are to be seen in the character of different main valleys as regards climate and vegetation. The opposite extremes are formed by such valleys as that of Solka—temperate and humid, with luxuriant growth of trees (silver fir, spruce, and beech), draped with moss, ferns, and lichens—on the one hand and of the Moldova, in its central part—hot and dry, with remnants of a steppe flora, and often bare hillsides—on the other. The existence of different types of vegetation in different districts is due partly to natural causes and partly to the action of man. The zone of conifers begins on the plain at a distance of about 12 miles from the mountains, the silver fir here predominating. In the more central parts beeches become more numerous, and, as firs alone are cut for export, often usurp the place of the characteristic mixed forests. Unmixed forests of conifers again appear in the higher region, being here formed mainly of spruce. The writer gives an interesting account of the various modes of transformation of forest into pasture, and the re-forestation of the latter where neglected, enumerating various transition forms between the two, in which birches often play an important part. Except in the steppe region and above the limit of trees, natural brushwood does not occupy any large area. Heather is hardly met with at all, but there are heath-like tracts with sphagnum and vaccineæ; also true peat-mosses and elevated grassy regions with alpine flowers, etc.

The Lakes of the Böhmerwald.—In the first number of the new volume of the *Geographische Zeitschrift*, Dr. Halbfass gives a short note on P. Wagner's study of the lakes of the Böhmerwald, which has been recently the subject of a dissertation at Leipzig by that observer for the degree of doctor. The principal results are said to be as follows: (1) Confirmation has been obtained of the view of Partsch and Bayberger—doubted by Penck and others—that the lakes in question are the results of ice-action during a glacial period, certain of the lakes having been shown to be held back by moraines, while polished and striated boulders have been found in their vicinity; (2) the shape of basin differs little in the case of the separate lakes; (3) diminution in area by the deposition of sediment is going on in all the lakes, but at very different rates. In the Great Arber-see and the Rachel-see it is much more rapid than in the Swarzer-see, in accord with the far greater extent of the area of precipitation in the two former cases. The last-named lake is the largest and deepest (130 feet), but the Teufels-see, with little more than a third its area, has a depth of 118 feet. The altitudes above sea-level are respectively 3307 and 3379 feet.

The Navigation of the Loire.—The second number of the *Tour du Monde* for the current year contains a short account by L. Gallouedec of the history of navigation on the Loire, the present state of the river, and the steps lately taken for its improvement as a waterway. It is pointed out that, though at the present day the Loire is almost deserted, it was much frequented during the early part of the century, until the introduction of railways rendered the river-traffic unremunerative. The chief difficulties arise from the nature of the river itself. Although subject to occasional devastating floods, it contains, as a rule, quite an insufficient supply of water, its bed being encumbered with shifting sandbanks, between which the channel meanders in a constantly varying course. In 1895, a company was formed at Nantes for the improvement of the waterway between that town and the confluence of the Maine, and it is hoped that in time vessels may again ply between

Nantes and Orleans, partly by the river itself, its bed being deepened and improved, and partly by a lateral canal. For the needs of the immediate future, an attempt has been made to utilize the river in its present condition by the adoption of light-draught vessels of a special type. The first of these, named the *Fram* after a more famous pioneer in another field, has already been launched, and made its first voyage from Nantes to Orleans in August and September last. It has a length of 135 feet, and maximum breadth of 18; the bottom is flat, without keel, and when fully laden with 80 tons of merchandise, the vessel draws only 2 feet 4 inches, its speed varying from 8 to 10 miles an hour. It remains to be seen whether the venture will be successful in diverting traffic from the railway to the river.

ASIA.

German Explorations in Asia Minor.—In Asia Minor, which has for so long been a special field of German research, considerable additions were made to our knowledge by journeys of German travellers carried out in 1896, of which the results have lately been published. Major von Diest, who with a brother officer made extensive journeys in the less-known parts of the basin of the Sakaria, gives the narrative of his experiences in a supplementary number of *Petermanns Mitteilungen* (No. 125), with much information on the ancient geography of the districts visited. With the aid of Dr. B. Hassenstein, he has prepared a revised map, in three sheets, of a considerable area of north-west Asia Minor, on the scale of 1 : 250,000. This is also the scale of Kiepert's great map, which has been used as the groundwork for that of Major von Diest, whose explorations (of 1886 and 1892, as well as 1896) have, however, enabled him to make many corrections in the topography. All the most important routes of recent travellers are shown, together with the railways, roads, and bridle-paths, and, where possible, the boundaries of administrative divisions. The nature of the surface features is shown with great clearness, and much information is given respecting the distribution of races, the villages being distinguished by symbols according to the affinities of their inhabitants. Major von Diest's routes followed for the most part bridle-tracks through the districts bordering on the Anatolian railway between Ismid and Angora. The most important deviations were, firstly, that to the town of Sidi-gasi, now identified with the ancient Nacoleia, on the upper waters of the Sakaria; and, secondly, a wide *détour* from Beilik-aghir, in the Pursak valley, through the country at the foot of the Ala-dagh, to Angora. Much new light is thrown on the hydrography, which presents some interesting phenomena. Describing the system of the upper basin of the Kirmir-chai, Major von Diest says, "The whole collected waters of the Kurt and Jaila Dagh, united into three main channels, pours itself at one and the same spot into a rocky rent, formed as if artificially by two perpendicular cuts, and, after rushing southwards for half a mile, winds eastward in sharp curves through the mountains, and makes its way to the plain through the rock-portal of Jabanca, 600 yards long." Some interesting details are given respecting the Angora railway. From that place to Bosujuk it traverses the bare, uninteresting plateau, but thence to Ada Bazar the journey is one of the most interesting possible. Descending through the deep cleft of the Kara-su, the line climbs down by giddy terraces, bridges, and rocky passes, and in one section there are fourteen tunnels within 3 miles.—Dr. W. Judeich's explorations, an account of which appears in the *Sitzungsberichte* of the Berlin Academy of Sciences (vol. 36), were undertaken for the purpose of supplementing some parts of Dr. Kiepert's map. They were chiefly concerned with the western and northern districts of ancient Mysia, especially the Scamander valley, the mountains south of the Troad, and the Kara Dagh and other ranges in the country bordering on the Sea of Marmora. The

paper treats largely of antiquarian remains, but contains new geographical matter, about sixty new places having been added to the map.

M. Bonin's Journey in the Chinese Empire, 1895–96.—The last part of the *Bulletin* of the Paris Geographical Society for 1898 contains a note by M. Bonin on the geographical results of his journey in Tibet, China, and Mongolia, of which some details were given in the *Journal* in 1897 (vol. ix. p. 515, vol. x. p. 94). It will be remembered that one of the most interesting geographical results of the journey was the discovery that the Yang-tse north of Tali-fu makes an unsuspected great loop to the north. The map now published lays this down somewhat differently from the sketch-map given with the preliminary account, as it shows the main stream as returning southwards to the bend near the Tali-fu lake, where it was crossed by Mr. Hosie, and thus removes the necessity of supposing that the latter traveller had mistaken a tributary for the main stream. M. Bonin's delineation is supported by the itineraries of caravans between Ta-tsien-lu and Tali, which cross the stream only a day and a half south of Yun-ning-tu-fu. The divergence is caused by a great range, with peaks varying between 16,000 and 20,000 feet. M. Bonin's exploration in the valley of the Yalung are also of much interest: on one of the passes by which the ranges on either side of its deep valley are crossed, he found what he considers the highest inhabited station on the globe. It is the abode, even in mid-winter, of a few yak herdmen, and lies at an altitude of 16,560 feet, or 500 feet higher than the mines of Thok-Jalung. M. Bonin compares this region to the Pamirs, though its deeply cut ravines would seem to be very different from the broad valleys of the latter. There are only two practical routes across it, one on each side of the central *massif*. Another section of the route on which information has hitherto been scanty is that from Cheng-tu to Lanchau. In the upper basin of the Kia-ling it led through country since visited by Mr. Litton (*Journal*, vol. xii. p. 187), but beyond this it traversed the divide between the basins of the Yang-tse and Hwang-ho, on which M. Bonin was able to throw new light, as his itinerary deviated from that of Potanin. The chains do not here run from east to west, but there is a rapid rise of level towards the west, forming the eastern edge of the Tibetan plateau.

Dr. Nieuwenhuis' Explorations in Borneo.—We have already referred briefly to Dr. Nieuwenhuis' successful journey across the island of Borneo, during which the Kapuas, the principal river of the south-east coast, was ascended to its source, and the west coast reached by way of the Mahakam. A full account of the journey, given by the traveller last year at a public meeting in Batavia, has appeared in the *Tijdschrift voor Indische Taal-, Land-, en Volkenkunde* (vol. xl. parts 5 and 6). The speaker began with a short general sketch of the island and the history of its exploration, drawing a strong contrast between it and the neighbouring island of Java, which presents a varied appearance and abundant signs of civilization as compared with the almost unbroken sea of vegetation met with in Borneo. The expedition was first set on foot in 1893–94, when Dr. Nieuwenhuis was associated with Prof. Molengraaf and Drs. Büttikofer and Hallier; but difficulties prevented the full realization of the plans at that time, though Dr. Nieuwenhuis paved the way to future success by establishing friendly relations with the Kayans on the Upper Kapuas. During his residence among this tribe he was able to collect a considerable amount of information respecting their manners and customs. He considers that, with proper regard on the part of travellers to the feelings and social regulations of the natives, there need be little fear of serious difficulties with them. One of the most singular beliefs among the Kayans is to the effect that each individual possesses two souls, which are ever ready to take flight, and thus entail various maladies on the body with which they are associated. The tribes on the

headwaters of the Mahakam are nearly allied to the Kayans, and Dr. Nieuwenhuis obtained the promise of the latter's support in any attempt to pass through the Mahakam region. Other duties delayed the renewal of the attempt till 1896, when Dr. Nieuwenhuis again reached the Kayan country, accompanied by assistants for the investigation of the zoology and botany of the districts visited. With the aid of the Kayans, the uninhabited tract between the Kapuas and the Mahakam was successfully crossed, and friendship established with the tribes on the latter river, in spite of the intrigues of a Malay freebooter who sought to prejudice the natives against the travellers. All the tribes of this region form a single group included under the name Bahau. They differ much from the Dayaks of the Barito and Kapuas, both physically and in their more independent bearing. They have a common commercial language, which is understood widely in North and East Borneo. Some difficulties arose owing to the scarcity of provisions among these people, but on purchasing a supply of rice from a neighbouring tribe, the party were allowed to establish a station in the virgin forest, where a considerable time was devoted to the zoological and botanical collections. Excursions were also made to various mountain summits for the purpose of checking the compass surveys. Finally, in December, 1896, canoes were purchased from the Pnihings, a neighbouring tribe, and in spite of the many rapids the Mahakam was safely descended to the head of steam-navigation at Tepu. In spite of attacks of malaria, the party generally maintained good health, much attention being paid by Dr. Nieuwenhuis to the question of hygiene. He is of opinion that the first requisite in malarious districts is the avoidance of chill, and insists on the necessity of woollen clothing for this object.

AFRICA.

Captain Wellby's Journey in the Galla Countries.—We have been favoured with details respecting Captain Wellby's expedition, contained in a letter from that traveller, dated "Lake Lamina, January 25, 1899." From the Maki river, which flows into Lake Zuai, Captain Wellby had proceeded *viâ* the western shores of Lakes Zuai, Hora, and Lamina to the camp from which he wrote, situated close to Wubarak. Lake Zuai was found to be fresh, the Suksuk river flowing from it between high chalk banks to Lake Hora (this, and not Hogga, is the true name). Both Hora and Lamina contain soda and saltpetre, but the latter is by far the more brackish of the two; all are full of hippopotami. On Lake Zuai and the Suksuk representatives of the Arusi Gallas were met with, but they were miserably poor, though formerly more flourishing. They are known as Waiyu and Gombo. West of the two northern lakes the country is said to be uninhabited. There are inhabited islands in Lake Lamina, but on attempting to reach them Captain Wellby was chased by canoes, though he succeeded in getting away without bloodshed. West of Lamina he came upon the Tuki Arusi Gallas, living close to the river Jiddo. They are friends of Menelik, to whom they give one tusk of every elephant they kill. They have no swords, but hunt with spears on ponies. Beyond these people to the west dwell the Adari and Wuragi tribes, also belonging to the Arusi Gallas, while near Wubarak the Guragues were met with. Captain Wellby was about to continue his journey *viâ* Kambat, which place he expected to reach in two days.

The Foureau-Lamy Expedition across the Sahara.—In spite of rumours of disaster, the latest news seems to show that the persevering attempts of M. Foureau to cross the Sahara south of Algeria are likely to meet with success. The explorer, with whom is associated Count Lamy as military commander of the expedition, has communicated to the Paris Geographical Society two letters, written in January, and giving details of his experiences down to the 26th of that month (*Revue*

Française, 1899, p. 210*). A telegram has also been received, bringing down the news to February 11. Early in December the expedition had reached the northern edge of the Tassili (plateau) of the Azjer, after a halt at Temassinin, which was to serve as the base for the further advance. On January 6, the date of M. Foureau's first letter, the party were in lat. 25° 19′ N., the Tassili having been safely crossed, though not without difficulty. Its western portion is known as Tindesset, and here the expedition was for five days passing across the limestone plateau, which reached a height of 5700 feet. The basin of the Igharghar had not yet been left. The surrounding region was essentially volcanic, a granite formation following immediately after the limestone. Towards the east lay an elevated *massif* named Adrar. On January 20 lat. 23° N. had been reached, at the post of Tadent, on the caravan route from Ghat to Air. The water-parting between the Mediterranean and the Atlantic had been crossed on January 9, at an altitude of 4690 feet. From Tadent a visit had been paid to the scene of the massacre of the Flatters Mission, but no remains of the unfortunate party existed. The well at which the massacre took place is named Tajenut, not Bir-el-Gharama, and lies 87 miles west-north-west of Tadent. On February 2 In-Azaua was reached, and the party was about to set out for Air. No aggression on the part of the Tuareg had been experienced.

Major Macdonald's Expedition.—A telegram from Mombasa on March 1 last announced the safe arrival at that place of Major Macdonald and his staff, on their return from the expedition through the northern parts of British East Africa. The Latuka country, east of the White Nile, seems to have been the furthest point reached by the main column, and this has been brought under British influence by a treaty with the king. Although compelled to join the Dervishes during the period of their power, he willingly embraced the opportunity of breaking with them. Captain Austin, whose work on Lake Rudolf was referred to in our March number, is said to have made a treaty with the Donjiro, whose territory extends beyond the 6th degree of north latitude. We have received various maps embodying the geographical results of the expedition, and hope to publish them on Major Macdonald's return.

Captain Bethe's Journey to the Ufumbiro Mountains.—The *Deutsches Kolonialblatt* for January 1 last contains the report of a journey made last year by Captain Bethe to the interesting volcanic region north-east of Lake Kivu. The German traveller advanced considerably to the north of Von Götzen's route, and his journey has resulted in geographical discoveries of some importance. Passing by the west end of Lake Mohazi, discovered by Von Götzen, Captain Bethe came upon a fine lake named Kifuha, surrounded by jagged mountains; the country here is named Bugira. Proceeding westwards across vast lava-fields, the party reached the volcano Kirunga-ya-Ufumbiro, which seems to be the easternmost of the line of peaks first seen by Captain Speke, and not the Kirunga of Von Götzen, of which the full name is Kirunga-cha-gongo. According to Captain Bethe, who ascended it, it reaches a height of between 13,000 and 16,000 feet, and will thus be considerably higher than the last-named peak (11,300 feet). The natives have built themselves dwellings beneath the lava-blocks, but have to fetch water from a distance, as the neighbourhood of the volcano is quite waterless. A small crater was found on the summit, and this was quite filled with water, which escapes by a subterranean channel. Some scanty springs on the mountain-side also send a subterranean stream to Lake Nyaburera, which in its turn sends its waters by a series of falls into Lake Nyaruhondo, which lies at 250 to 300 feet lower level. Captain Bethe

* The earlier course of the expedition is described in the February number of the same journal (p. 94).

thinks that the outflow of the latter joins the Nyavarongo. Turning east and south, and passing through a district inhabited by dwarfs, the expedition struck the Kagera near a wide lagoon formed by an expansion of its bed a little below the junction of the Nyavarongo and Akanyaru; then crossing the routes of Baumann, Ramsay, and others, it made its way, with some fighting, across the Ruvuvu and Luvirosa to Muyaga, at which place the White Fathers had arrived a few days previously. Thence Captain Bethe was hurriedly called to Ujiji by news of a threatened revolt of the Arabs, which, however, soon fell to the ground.

The Béhagle Expedition to Lake Chad.—The *Revue Française* for April announces that before November 19, 1898, M. de Béhagle had made two journeys to Bagirmi, in the course of which he had carefully surveyed the course of the Gribingi and that of the Shari as far as 10° north. He had also made a ten days' voyage on the Bamingi, above its junction with the Gribingi, and had explored several other streams. In the same journal it is recorded that M. Gentil has been appointed French Commissioner on the Shari, for the purpose of occupying Bagirmi and other parts of the basin of Lake Chad.

Railway Project for French Congo.—An expedition, under the command of A. Fourneau, was last autumn set on foot for the examination of a route suitable for a railway from Libreville to the Congo (*Revue Française*, April, 1899). Early in November the whole party reached Brazzaville, whence the leader set out on the 8th of that month for Wesso, on the Sangha. This was to form the rendezvous of the expedition, which was expected to unite there about the end of February.

German Expedition to the Sanga.—A German expedition for the exploration of the south-east corner of the Cameroons territory, on the Sanga river, set out at the end of last year, under the leadership of Dr. Pleyn. It is proceeding by way of the Congo, where it arrived in December. Dr. Pleyn is well provided with instruments for the astronomical determination of positions, and will begin work on the Ngoko, the western branch of the Sanga. The correct fixing of positions in this region is of importance with regard to the course of the boundary between the Cameroons and French Congo. A German expedition to Lake Chad has also been projected, but the idea seems at present in abeyance.

New Route to Karema, on Lake Tanganyika.—A journey from Bagamoyo to Karema was made in 1897 by Père Dromaux, of the "White Fathers," by a more direct route than any followed by previous travellers. A short account of the journey, with a map based on Père Dromaux's journal, is given by Paul Langhans in the first number of *Petermanns Mitteilungen* for the current year. The chief interest of the route lies in the second half, which led from Iseke, in Western Ugogo, through the districts of Ukimbu and Ukonongo, joining the routes of Prince and others (cf. *Journal*, vol. xii. p. 79) in the former, with those of Kaiser, Thomson, etc., in the west of the latter. Between Iseke and Itumba, the first sub-district of Ukimbu, the traveller crossed a long uninhabited stretch, in which water could everywhere be obtained by digging (in September), while in the wooded region on the frontier both water and game were found in abundance, the latter including antelopes, gazelles, etc., and even elephants. The chief place in Itumba lies on an elevated plain exposed to strong and cold winds, which blow from midnight to midday; the "tembes" are scattered over an area two days' march in diameter. Kiwele, too (separated from Itumba by an uninhabited tract), occupies a wide plain, with somewhat sandy and badly cultivated soil, though bananas are grown here and there. The cattle has much diminished, owing to the Wahehe raids. The female chief of Kiwele belongs to the people of Unyanyembe and [illegible] different languages

are spoken, by reason of the number of slaves and adventurers who came into the land in the time of her grandfather; there are a few villages of Wangwana. The boundary between Ukimbu and Ukonongo, which has been hitherto indefinite, is placed by Père Dromaux at the Muangwa, a right-bank tributary of the Rungwa (basin of Lake Rukwa). The first district of Ukonongo reached was Kabuye, formerly conquered by Nyanga of Kiwele, but now re-occupied by its old chief, Kakuiko, who has built a new town at Ilunde, where his people cultivate some manioc and sugar-cane. In Magulu, likewise, the old trading-station Suke, visited by Kaiser in 1882, but since destroyed, has lately been rebuilt. Arrived at Mpimbwe, still forming part of Ukonongo, Père Dromaux turned southwards to visit Olelo, the chief town of the district, and the largest place seen by him since leaving the coast. The old chief Kasogea was in power so far back as the time of the murder of Captain Carter and Mr. Cadenhead by Mirambo's "Ruga-ruga." The Kafuu where crossed had no water on the surface, though higher up, in July, its bed was full, and crocodiles and hippopotami were seen. It unites with the Rungwa, which, contrary to previous reports, Père Dromaux considers to be the chief stream; its source is placed by him further east than on previous maps. The further route along the foot of the Fipa plateau led across a succession of difficult gullies, and a similar country was also traversed after the Tanganyika basin had been reached. The Kataui steppe, in the centre and north of Mpimbwe, becomes an impassable lake in the rainy season, and its soil is rich black humus. Amongst the results of the journey is the clearing up of the direction of Carter's last march, as well as the introduction of corrections as regards Thomson's route of 1880.

Survey of the Lower Limpopo.—During the Portuguese military operations in East Africa in 1895 a gunboat was sent up the Limpopo as far as the point known as Gungunhana's ford. Her commander, Lieut. de Andréa, took as careful a survey of the river as the circumstances of the campaign permitted, and has given a sketch of the results in the ninth part of the sixteenth series of the *Boletim* of the Lisbon Geographical Society, accompanied by a large-scale chart of the river. The reconnaissance was made in December, at the time of low water, and great difficulties were experienced in navigating the vessel. These began at the Ilha Verde in 24° 53½′ S. lat., where a passage was not effected until after eight and twenty hours' incessant toil. From this point to the lower end of Monleane island, in 24° 48½′, navigation was comparatively easy, but the river then soon began to get shallower. A little south of 24° 45′ two branches were seen; but that from the west, which continued the direction of the river below the junction, was soon found to be completely blocked. Lieut. Andréa thinks, however, that at high water it forms a continuous channel, giving a more direct passage than the eastern branch to the surplus water. The Changane, a tributary on the left bank a few miles higher up, proved to be navigable, though narrow; it flows immediately under Mount Chibuto. Above this, a little below Gungunhana's ford, the Limpopo was almost blocked by a bar of hard micaceous clay, and only after a long search was a channel discovered with 2½ feet of water. When the river is at its lowest, a fall probably occurs here. The ford itself is passable, as natives who were seen to cross by it were immersed up to the neck. From this point the gunboat was ordered to return, so that the reconnaissance could not be continued further. Lieut. Andréa thinks that the river will in the near future become an important channel of communication with the interior, for its bar is not now considered so dangerous as formerly. The high water-level rises at intervals of a few years more than 24 feet above that observed at the time of the survey; the whole plain bordering on the river-banks is then flooded.

The Austrian Expedition to Arabia and Sokotra.—We learn from Vienna

that most of the members of the expedition sent out in September, 1898, by the Vienna Academy of Sciences for the exploration of Southern Arabia (*Journal*, vol. xii. p. 521), returned to the Austrian capital about the middle of April. A short communication on the results of the expedition has been made to the Imperial Institute of Geology in Vienna by the geologist of the party, Dr. Franz Kossmat, who reports that, in spite of the short time spent in Arabia, he has succeeded in making some interesting geological observations on the south coast of that country. More important results have, however, been obtained from the island of Sokotra, as well as from the small islands of Abd-el-Kuri and Samha,* lying between it and Cape Guardafui. Not only has Dr. Kossmat been able to construct the first geological maps of the islands, but he has made valuable additions to our knowledge of the topography of Sokotra, which is shown in its broad outlines only on existing maps. An interesting point mentioned is the fact that the districts on the islands which belong to the Cretaceous and Eocene formations, exactly resemble in morphological character the "Karst" lands of Austria.

The Tsetse Fly Disease.—Laboratory researches have lately been carried on, by a committee appointed by the Royal Society, for the purpose of throwing light on the Nagana or tsetse disease, and especially of discovering methods of prevention, cure, or immunization. Messrs. Kanthack, Durham, and Blandford, to whom the experiments were entrusted, have made a preliminary report on their labours down to August last, which is printed in vol. lxiv. of the *Proceedings of the Royal Society* (No. 404). So far the results have been mainly negative; but the work is being continued, and it is to be hoped that some method of dealing with the scourge may at length be discovered. The first experiments recorded deal with the susceptibility of different animals to the disease, a number of different species, from the smaller animals, such as dogs, rats, etc., to large animals like the horse, having been inoculated with diseased blood. In almost every case the disease was developed and proved fatal in a longer or shorter time. A bosch-bok died without showing any decided symptoms, but it was found that hybrids of zebra and horse, as well as of zebra and ass, were equally susceptible with other horses and asses. The writers consider that the experiments made by Koch on hybrids are inconclusive, as there was no proof that the animals were ever really infected. Guinea-pigs, though susceptible, proved more resistant than the other animals experimented on, while pigeons, the only birds yet tried, showed no signs of infection. Other points touched upon are the mode of infection, symptoms of the disease, and so on. Endeavours to produce immunity by inoculation in a variety of ways have so far proved entirely unsuccessful, nor have any means of cure or alleviation of the disease been discovered. Investigations into the life-history of the hæmatozoon, discovered in the blood of infected animals by Surgeon-Major Bruce, have led to no very complete results. The parasite is closely allied to the *Trypanosoma* present in the Surra disease of India, and, according to Koch, is identical; but this cannot be considered proved, though the diseases seem closely similar. The *Trypanosoma* discovered by Rouget in a horse in Algeria is also similar to that present in tsetse-fly disease, but the form occasionally found in English rats seems quite distinct. A full report will be published on the completion of the observations.

AMERICA.

Cartography of the State of Maryland.—The latest Report of the Maryland Geological Survey (vol. ii.) contains an important summary of the history of cartography of the state by Mr. E. B. Mathews, under the title of the "Maps

* Named also Samneh, Sumlah, and Samleh on existing maps.

and Map-makers of Maryland." Commencing with Ayllon's map of 1527, a description is given of the leading maps of the state, together with notices of the men who made the sketches and surveys for them. Many interesting facts are revealed by a study of the early maps, regarding the physiographical changes which have occurred in historic time along the Chesapeake and Atlantic coast-line. The early cartographical representation of the territory of Maryland is mainly devoted to the delineation of the shores and lands bordering on the Chesapeake and the Potomac. Captain John Smith, in his voyage up to the mouth of the Susquehanna, gained more information regarding the character of Chesapeake bay than did any of his successors. The features of particular value in the Smith map are the shores of Somerset, Dorchester, and Cecil counties, and the coast-line between the Patapsco and Point Lookout. The Lord Baltimore and Alsop maps, of 1635 and 1666, show some slight advance in knowledge; while the Herman map of 1670 for the first time presents an accurate delineation of the shore-line between Cambridge and Chestertown. Some slight knowledge was acquired during the middle of the eighteenth century regarding the regions of the Appalachians west of the Blue Ridge and the valley of the Shenandoah. Scarcely anything was known of the mountainous country lying at any distance from the north branch or the south branch of the Potomac. The map drawn by Fry and Jefferson in 1751 gives some information, but it was not until Griffith's map of 1794 was published that the knowledge acquired of the western portion of the state was rendered available. No attempt was made to delineate the inequalities of the surface until the inauguration of the work by Alexander and Ducatel, while little was attempted in the way of road traversing prior to the extensive surveys by Martenet. The following maps are mentioned as representing the most accurate cartographical information at the present time: the map now being issued by the United States Geological Survey, which covers a large area of the state; the charts prepared by the Coast and Geodetic Survey, representing the territory adjacent to and underlying the Chesapeake waters; while for the officially unmapped portions, the state maps published by Martenet are recommended, although stated to be at least ten years out of date. For the eastern shore of Maryland, as also for the northern portions of Cecil, Baltimore and Carroll counties, the early atlases published about twenty years ago are said to be the most accurate and detailed. The present Geological Survey, in co-operation with the U.S. Geological Survey, is rapidly reducing the unmapped portions of the state, and it is hoped that within a few years sufficient material will be to hand for an adequate representation of the physical geography of the state upon a large and uniform scale.

Richard Ludwig's Journey in Santo Domingo.—Prof. Sievers has done a service to geography by publishing in various German geographical journals the results of the extensive journeys of the deceased traveller, Richard Ludwig, in the countries bordering on the Caribbean sea. The latest instalment, dealing with Ludwig's travels in the island of Santo Domingo, appears in the *Zeitschrift* of the Berlin Geographical Society for 1898 (part 5). Born in 1849 at Waldmannshofen in Würtemberg, Ludwig applied himself in his early years to the calling of an apothecary, and after the Franco-German war, in which he took part, became director of a quinine factory at Munich. In 1883 he went out to Puerto Cabello on behalf of a guano syndicate, and spent the rest of his life in Venezuela and neighbouring countries, making constant journeys for the investigation of their mineral resources, and visiting many districts generally avoided by European travellers. Dr. Sievers himself accompanied him on one of the journeys, and bears witness to the trustworthy character of his observations, which relate to the botany, as well as to the general geological relations of the countries visited. Those made in Santo Domingo are of special value, not only on account of the scantiness of our information

on the island generally, but because they shed new light on the structure of the island and its relation to other lands bordering on the Mediterranean sea of America. Ludwig made three principal journeys in the island, the first, undertaken in 1888, being the most important of all. It led from Santo Domingo along the coast to Azua, thence to the Laguna de Enriquillo, and northwards to San Juan and the upper Artibonite, in the great north-west plain. In returning, the traveller took a northerly route from Azua, which led across the higher inland ranges in the neighbourhood of Piedrablanca. On the second journey, he proceeded by sea to Sanchez, on the north-east coast, and thence made his way to Macoris, returning to Santo Domingo overland by way of Cotui; the most valuable result was the study of the northern range of the island, the Sierra de Monte Cristi. The third journey was mainly by sea along the south coast, the islands of Beata and Alta Vela being visited, and the latter proved to be due to recent eruptive agencies. Prof. Sievers gives detailed accounts of the journeys from the traveller's own notebooks, and ends with a summary of the conclusions to be drawn as regards the geological structure of the island, showing in particular the modifications to be introduced into Gabb's account of the same. The most important result is the proof that the island possesses a sub-structure of archaic rocks, which, in association with vast eruptive masses, can thus be traced both on the north and south, as well as, in part, on the east, of the Caribbean sea. The paper contains a large-scale map, showing Ludwig's routes and the mountain systems of the central part of the island; the distribution of crystalline schists, etc., being shown on an inset.

Mr. Hill on the West Indies.—Mr. R. T. Hill, of the United States Geological Survey, has written a comprehensive book on the West Indies,* treating each of the islands or minor groups in well-proportioned detail. Though the names of Cuba and Porto Rico appear more prominently in the title, these islands do not receive more space in the descriptions than their extent and importance justify. The book is appropriately dedicated to Prof. Alexander Agassiz, in appreciation of his important researches into the physical geography of the American Mediterranean. In his introductory sketch of the geographical position of the West Indies, Mr. Hill lays stress on the fact that North America lies on the whole to the west of South America, while Central America forms a west-to-east-running peninsula connecting the two. Stress is also laid on the fact that the high ground along the west coasts of North, Central, and South America is no proof of the existence of one continuous mountain range. There are distinct breaks in its continuity, and before the upheaval of Central America the northern and southern (or western and eastern) continents were connected by a continuous or nearly continuous land-bridge along the line of the Antilles. The system of the Andes, if continued, would be found to curve eastward and northward, while that of the Rocky mountains, if continued, would curve westward and southward, the two mountain systems running parallel and about 2000 miles apart. A third or Antillean mountain system runs between the two, with a prevailing west-to-east trend. On these three mountain systems due to great Earth-folds, volcanic mountains are parasitic, but their distribution is irregular. The general result, however, is that the Caribbean Sea is bordered on the east and west by volcanic chains, and on the north and south by fold-mountains. In classifying the islands according to their nationality, Mr. Hill points out that many of the islets and reefs, such as Aves and Roncador, are beyond the pale of any government, a fact which he explains either by their intrinsic worthlessness

* 'Cuba and Porto Rico, with the Other Islands of the West Indies: their Topography, Climate, Flora, Products, Industries, Cities, People, Political Conditions, etc. By Robert T. Hill. London: T. Fisher Unwin. 1898.

or by the fact that acknowledged ownership would involve expensive responsibilities, such as the placing of lighthouses. The general results are summarized in three chapters, on the Geological Features of the West Indies, Race Problems in the West Indies, and the Future of the West Indies. There are many excellent views, but the maps are few and not of the best quality. One fact of interest noted is that the Negro race has no tendency to increase in Cuba, as it does in the other islands of the West Indies. The 520,000 people of African descent, half of them mulattos, who lived in Cuba before the fatal effects of Weyler's policy began to act, are all that now represent the importation of over a million African slaves. Mr. Hill pays a high tribute to the organization and administration of the British West Indian islands.

AUSTRALASIA AND OCEANIC ISLANDS.

Annual Report on British New Guinea.—The last annual report of Sir Wm. Macgregor as administrator of British New Guinea, which has lately been issued as a Parliamentary paper, gives an account of the general progress of the possession during 1897–98, besides containing various reports on matters of scientific interest. The geographical matter is to be found chiefly in the reports of visits to little-known districts, some of which have already been published from time to time, and have been noticed in our pages. Another valuable contribution, however, is the large-scale map (6 miles to the inch) in four sheets, of the south-eastern part of the possession, which embodies the results of recent explorations in the whole south-eastern end of the island beyond the German frontier. It has been prepared under the direction of the Surveyor-General of Queensland. Some geographical items included in the report have apparently come to hand since the publication of the map. The latter shows, *e.g.*, the Yodda branch of the Mambare as occupying a great longitudinal valley running far to the south-east, but from a sketch-map showing the tracks cut by a prospecting party in this district, it seems that the upper course of the Kumusi (which enters the sea to the east of the Mambare in about 148° 15′ east) runs from south to north across the supposed line of that valley, which does not extend east beyond 147° 50′, the Yodda rising at the east end of Mount Parkes. A report of geographical interest not previously referred to is that by Mr. A. C. English, on a journey from the Rigo station to the eastern slopes of Mount Potter, near the sources of the Kemp-Welch river. It led across the Musgrave river by a very rough track over the spurs of Mount Bride. The Musgrave valley is reported as quite uninhabited, but the land on both banks is of excellent quality. In the neighbourhood of Mount Potter the Memai branch of the Kemp Welch river was reached; it is said to rise on the north-west side of Mounts Baron and Obree. The main branch is the Adai, which runs through the Nesbit valley, and is reported to be in flood all the year round. Among the appendices are to be found meteorological returns from Dogura, Port Moresby, and Daru; notes on Totemism; and reports on botany and mineralogy, including one by Mr. Hemsley on the alpine plants of the Owen Stanley range. The remarks by the administrator on the general condition of the possession are, on the whole, encouraging. The valuable results of the work of the missionaries are ungrudgingly recognized. Satisfaction is expressed at the increasing use by the natives of courts of law, and the progressive employment of natives during the last decade. During that time great progress has been made with the pacification of the country, and the examination of its resources can now proceed deliberately and continuously. The colony awaits agricultural development, which can only be effected by Europeans, and is, without doubt, the most pressing need of the country at the present time. It can be carried out, not only without detriment to the rights of the natives, but even to their positive advantage.

Dr. Von den Steinen's Visit to the Marquesas Islands.—The well-known German ethnologist, Dr. Karl von den Steinen, gave before the Berlin Geographical Society in December last an account of his visit to the Marquesas islands, made in 1897, for the purpose of collecting ethnological objects for the Berlin "Völkermuseum." From the point of view of ethnological science, such a collection from the most easterly outposts of the Polynesian race was of the first importance, not a single museum in the world possessing, previously to Dr. von den Steinen's visit, one in any way adequate to supply detailed information to students, while the knowledge possessed of the language, traditions, and mythology of the people of the group was very far from being complete. Leaving San Francisco by a sailing-ship of the line subsidized by the French Government, and experiencing some trial of patience while passing through the belt of calms, Dr. von den Steinen arrived, at the end of three and a half weeks, at the Bay of Taiohae, the chief port of the Marquesas. He made *en route* observations on the salinity of the sea-water, which gave results agreeing well with the curves on the official "Segel-Atlas." The Marquesas group, discovered in 1595 by Mendaña, and named by him in honour of the Marquis of Mendoza, Viceroy of Peru, consists of twelve islands, scattered roughly over 3° of latitude and 3° of longitude, and forming three groups in a line from north-west to south-east. Both physically and politically it forms a kind of dependency of Tahiti. Its scenery is uniform, and severe rather than beautiful. Of volcanic origin, the islands have no craters, but consist of massive felspathic rocks rising to a height of 4000 feet, with sharp central ridges, whence diagonal spurs run down to the sea, enclosing steep-sided valleys. The two principal islands are occupied by plateaux 1400 to 2000 feet in height, with steep ascent from the coasts. Vegetation is luxuriant in the deeper valleys and on the heights exposed to the trade winds, but elsewhere the slopes are treeless, but grassy. The main point of difference from Tahiti is the absence of fringing reefs and of level plains, which diminishes their agricultural value. Copra, cotton, and fungus are the chief exports, but coffee has lately been introduced. The settlements stretch from the shore for about 250 yards inland, and the inhabited islands have a population of little over one to the square mile. The entire alteration in the manners of the people under the influence of the missionaries made Dr. von den Steinen's researches into the primitive customs and traditions a work of great difficulty, and information was only to be obtained from aged survivors of a former generation. Among the points touched upon in this connection, the most interesting is that relating to the place of origin of the islanders and their traditional home, Hawaii (whence the Hawaian group had its name), whither the spirits of the departed are believed to return. Many authors have considered the place to be purely mythical, but Dr. von den Steinen is inclined to think it historical, and to identify it with Sawaii, the principal island of the Samoa group; for whereas Hawaii is always associated by the islanders with Vavau, Tonga, and Fiti (Fiji), the Samoa group would be left out entirely unless it were represented by Hawaii.

Pitcairn Island.—From the 'Correspondence' [C. 9148] recently issued regarding the condition of the Pitcairn islanders, we note the following particulars. Owing to the gradual disappearance of trees, which formerly grew all over the island, and the consequent washing away of the soil on the steep slopes, Pitcairn now presents a somewhat barren aspect. This loss of trees seems to have affected the climate of the island, as droughts now appear to be of frequent occurrence. There is still a large area of deep and fertile soil left in the valleys and on the hills in the interior. The island produces oranges, yams, and sweet potatoes, arrowroot, and coffee. The population, including children, numbers 141 souls—70 males and 71 females. The people are said to be fast degenerating through the effects of

inter-marriage and over-population. It is thought that if regular communication with the island were established, it would go a long way towards correcting the present unsatisfactory state of affairs.

POLAR REGIONS.

Swedish Expedition to Bear Island.—Mr. J. G. Andersson, of Upsala, who accompanied Prof. Nathorst on his expedition last summer, is now preparing an expedition to Bear island. Prof. Nathorst, having found the geology of Bear island exceedingly interesting and worthy of a more minute survey than could be made last year, has encouraged Mr. Andersson to undertake the expedition, for which the Swedish Society of Anthropology and Geography has voted the balance of the Vega Fund. A contribution has also been given from "Lars Hiertas Minne" ("The Memory of Lars Hierta"), and the little amount which still rests will no doubt be obtained through private contributions. It is the intention of Mr. Andersson and his two fellow-naturalists to leave Tromsö in a steamer in the beginning of June. After having landed on Bear island with tents and provisions, they will remain there until the middle of August, when they will be fetched by one of the steamers going between Norway and Spitsbergen.

Arctic Expedition of the Duke of the Abruzzi.—During the present spring, the Duke of the Abruzzi has been pushing forward the preparations for his arctic expedition, on which he hopes to start during the early summer. He has purchased a Norwegian steam whaler, which has been altered to suit the object in view, and has been named the *Stella Polare*. It will be remembered that the prince's plan is to winter in Northern Franz Josef Land, and thence make an advance towards the pole during the spring of next year.

The Belgian Antarctic Expedition.—The anxiety which was beginning to be felt as to the fate of the Belgian antarctic expedition has been happily dissipated by a telegram announcing its return to Punta Arenas on March 28. The *Belgica*, under the command of Captain Gerlache, with a large scientific staff, sailed from Antwerp on August 16, 1897, and was last heard of in Magellan strait in December of the same year, when she left for the far south with the expectation of reaching an Australian port before winter. The *Mouvement Géographique* prints the following telegram from Captain Gerlache: "I regret to have to announce the death of Wincke, on January 22, 1898, and of Danco, on June 5, 1898; otherwise all on board are well. The results are very satisfactory, and good collections have been made. We visited Hughes bay and Palmer Land, making a hydrographic reconnaissance of that district, collecting many specimens of rocks, and landing on twenty occasions. We then steered for Alexander I. Land, and entered the pack to the west of that land: the extreme southerly point reached was 71°.36′ S., in 92° W. Obliged to winter; experienced a great deal of bad weather, but no intense cold except during September, when the minimum temperature was 45° below zero Fahr. on September 8, 1898. Much drifted about by the wind, but got clear of the pack on March 14, 1899, and reached Punta Arenas on the 28th. Send letters to Punta Arenas." Lieut. Danco, of the Belgian Artillery, was in charge of the physical observations, and Mr. Wincke was a Norwegian volunteer. Dr. F. A. Cook, who accompanied Mr. Peary on his expedition in 1891, and joined the *Belgica* as surgeon, telegraphed on April 4 to the Brooklyn *Standard Union*, announcing that the *Belgica* had reached Montevideo on that day on her way home, having abandoned the intention of returning to the antarctic regions. He states that the expedition was a complete success; the deaths were due to accident, not disease. He also states that much new land was discovered in Weddell sea. It is scarcely probable

that Captain Gerlache should have omitted to mention a visit to Weddell sea if the *Belgica* had cruised in those waters. His account of the route obviously implies that the ship kept to the west of Graham Land. The *Belgica* is the first vessel which has ever wintered in the antarctic ice, and no human beings have previously spent a winter in so high a southerly latitude as the ship's company of the *Belgica*. They followed very much the route of Bellingshausen in 1821, and Cook obtained his highest latitude about 300 miles further west than the *Belgica*.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

New Determination of the Pole of the Land-Hemisphere.—Although a large number of our atlases give maps showing the division of the globe into a land and water hemisphere, these have not hitherto been based on any exact calculation, but have often been drawn for the horizon of one or other of the capitals of North-Western Europe. The first attempt at a more scientific determination of the true pole of the land-hemisphere has been made by Dr. H. Beythien, who has lately published the results of his investigations in pamphlet form (Kiel & Leipzig: Lipsius & Tischer, 1898). For the object in view, he has made use of a method recommended in 1896 by Prof. Krümmel, and described in *Petermanns Mitteilungen* for 1898 (part 5). The first part of his paper, however, is taken up with historical notes on the origin of the idea of a land-hemisphere. The writer points out that a distinction must be drawn between "horizon-maps," or those drawn for the horizon of particular places, and those of which the true object has been the division of the globe into land and water hemispheres. Before the second voyage of Cook (1775) had given the first approximately correct idea of the distribution of land and water, any attempt to show the latter was necessarily based largely on guess-work; still attempts were made, and the earliest of these is considered by Dr. Beythien to be that of Buache in 1746, or several years before the publication of Boulanger's memoir (1753) to which Wisotzki has lately attributed the first mention of the idea. Other early maps are considered as merely horizon maps, though it is to be observed that Colson (1735), as quoted by Dr. Beythien, expressly states that his hemisphere, constructed for the horizon of London, exhibited "vastly the most considerable part of the whole Earth's superficies." The method employed by Dr. Beythien is as follows: It is at once seen that the chief land areas whose position in one or other hemisphere is doubtful are parts of South-East Asia and of South America. An antipodes map of these regions is therefore constructed on the gnomonic projection, in which all great circles appear as straight lines. That line which leaves the largest possible area of Asia on one side and of South America on the other will represent the bounding-line of the true land-hemisphere. For seventeen such lines, drawn so as approximately to fulfil the required conditions, Dr. Beythien has calculated the areas by means of Wagner's tables of one-degree squares. The result shows that the best line is that which gives as the pole a point just outside the mouth of the Loire, in 47½° N., 2½° W. Of the poles corresponding with the ten best lines, not one falls in Southern England, where Ritter considered the point to lie, nine occurring in France or near the French shores, and the tenth in Catalonia. The point near Cloyes, recommended by Penck, takes the thirteenth place only, London the fourteenth, and Paris the fifteenth. For the known portions of the land and water hemispheres respectively, Dr. Beythien finds the proportion of water to land to be as 13 : 12 and as 14·4 : 1.

Influence of Wind on the Speed of Steamers.—The common phrase that steam-power makes vessels independent of wind or tide has perhaps unconsciously led landsmen, at least, to under-rate the influence exerted on the speed of powerful

steamers by the direction and force of the wind. Herr L. E. Dinklage discusses in the *Annalen der Hydrographie* for January, 1899 (p. 34), the observations recently made on the North German Lloyd steamers *Werra* and *Fulda*, vessels of about 5000 tons and 15 to 16 knots, during a number of voyages across the Atlantic, between Gibraltar and New York. When classified according to direction and strength of the wind, the results show that when the wind was favourable, no difference whatever could be detected on the speed of the vessel during a light breeze or a strong gale. With a beam wind, however, a reduction of as much as 3·25 knots was noticed in the speed, from 15·7 knots with a light wind to 12·5 with a gale. Head winds naturally were still more serious hindrances to speed, the rate varying from 15·7 in a light breeze to only 10 knots in a gale. It is pointed out, of course, that other causes besides the force of the wind have to do with the reduction of speed; but fogs do not usually occur with strong winds, and a heavy sea is a direct consequence of the wind, so that the two may be classed as a common cause. It is not stated whether the vessels carried any sail. The obvious result of these observations is that the wind never helps a fast steamer when favourable, no matter how strong, but always hinders when unfavourable. Probably with vessels steaming 10 knots or less, a favouring gale might have some good effect.

Seismology.*—The growth of the science of seismology from the mere recording of earthquakes and their effects is well illustrated in this volume, the second which Prof. Milne has contributed to the International Science Series. In the advanced study of seismology which is now possible, the destructive violence of earthquakes is retiring into insignificance in comparison with the more frequent, and indeed almost continual, movements of a gentler type. Thus Prof. Milne commences with the discussion of bradyseisms, the slow and gentle movements of elevation or depression in the Earth's crust, and all the observations he has collected go to show that the surface of the Earth—the inalienable domain of the geographer—is neither fixed nor firm, but in a state of continuous flutter. It must, in fact, be looked upon as moving about a position of equilibrium disturbed by every re-distribution of matter on the surface, by the movements of air and water no less than by the more massive lightenings and loadings of denudation and deposition, and the violent readjustments of volcanic eruptions. Prof. Milne shows how the normal tremor of the crust is related to the earthquake shock, and describes the various ingenious instruments by which the observations have been made. He gives instructive examples of the manner in which the style of architecture imported from stable lands into earthquake-shaken areas have been modified, and new styles introduced designed to resist destruction by seismic shocks. The practical applications of the science of seismology are indeed by no means the least important of the many interesting facts dealt with in the book.

GENERAL.

Honour to Sir John Murray.—The Council of the American Geographical Society of New York have awarded the Cullum Geographical Medal to Sir John Murray, in recognition of his many distinguished services in the cause of science. The medal bears the inscription, "Awarded to Sir John Murray, K.C.B., Naturalist, Deep-sea Explorer, Oceanographer, Editor of '*Challenger* Reports.' MDCCCXCIX." At the request of the American Geographical Society the medal will be presented to Sir John Murray by the American Ambassador at a meeting of the Royal Geographical Society.

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* 'Seismology.' By John Milne, F.R.S. London: Kegan Paul, Trench, Trübner & Co., Ltd. 1898.

OBITUARY.

Commander F. G. Dundas, R.N.

We regret to record the death of Commander F. G. Dundas, well known to our readers for his pioneer work in East Africa, especially in connection with the navigation of the Jub, which he ascended with a light-draught steamer for the first time since the date of Baron von der Decken's unfortunate expedition. The deceased officer entered the navy in 1860, and after serving in various ships in the Mediterranean and elsewhere, was appointed to the command of the *Fervent* on the coast of England in 1874. He subsequently commanded the *Mallard* on the west coast of Africa, and afterwards served in harbour ships and in the coast-guard. In 1890 he retired with the rank of commander, and in the following year was appointed commissioner and principal naval officer to the British East Africa Company. Before exploring the Jub, he had in this capacity done useful work by the ascent of the Tana to Mount Kenya. In 1893 he became superintendent of marine in the Niger Coast Protectorate, and afterwards held the post of naval adviser to the Chinese Government.

Dr. G. W. Leitner.

The well-known Oriental scholar and linguist, Dr. G. W. Leitner, died from pneumonia at Bonn, on March 22 last. Although subordinated to his other pursuits, his services to geography were by no means inconsiderable; his knowledge of the wild frontier districts between India and Afghanistan being particularly extensive, and, before recent events had thrown open those regions to a wider circle of inquirers, perhaps unrivalled. Gottlieb William Leitner was born at Budapest in 1830, and educated at Constantinople, Brussa, and King's College, London. During the Crimean war he acted as first-class interpreter to the British Commissariat, and afterwards became lecturer and eventually professor of Arabic at King's College. A few years later he went out to India as principal of the Government college at Lahore, and soon became warmly interested in the extension of education among the natives of the Punjab, where he succeeded in founding the Punjab University, besides doing much in other ways for the cause of education. In 1866 he was entrusted by the Punjab Government with a mission beyond the North-West frontier, which he carried out with success, the results being published as a Government memoir. His experiences at this time are also embodied in a subsequent work entitled 'Dardistan in 1866, 1886, and 1893.' On his return from India, he founded an Oriental institute at Woking. Dr. Leitner's studies embraced a wide range of subjects, and he is said to have been conversant with over twenty-five languages.

Mr. G. E. T. Smithson.

We greatly regret to announce the death, on April 10, from pneumonia following influenza, of the Secretary of the Tyneside Geographical Society, Mr. G. E. T. Smithson. Mr. Smithson, who was a Newcastle merchant much occupied with business affairs, devoted a very large part of his time to the management and development of the Geographical Society, which he had been largely instrumental in founding. In 1887, when the suggestion was put forward that a geographical society might be started in Newcastle, Mr. Smithson was the first to give his enthusiastic support to the proposal. It is mainly to his energy that the great

success of the society and its strongly practical character are due. Originally established in small rooms, the society was enabled in 1890 to purchase the old Presbyterian church at Barras Bridge, which was converted into a geographical institute, and here the leading travellers and explorers have lectured to large audiences. Mr. Smithson was well known at the meetings of the British Association, which he rarely failed to attend, and always took an active part in the committee of Section E (Geography). He was also much interested in promoting relations between the Royal Geographical Society and the provincial societies. His death will be a serious loss to the society, which was so largely a reflex of his personality, and to the cause of geography in the north of England.

CORRESPONDENCE.

The Canadian Rockies.

On reading Prof. Norman Collie's paper, "Exploration in the Canadian Rockies," printed in the current number of the *Geographical Journal*, I notice that Mr. G. P. Baker, in commenting on that paper, refers to my own travels, in 1859, in the same regions, and remarks, "It is very difficult indeed to determine exactly where he (Lord Southesk) was; but, roughly speaking, he must have been in the neighbourhood of the headwaters of the Athabasca, journeying south to the Bow valley in a second parallel valley to the main range."

I believe that this will prove to have been the case, and my son, whose Australian explorations have recently been submitted to the Royal Geographical Society, has come to a similar conclusion—having applied the skill he possesses in laying down routes to laying down mine on Prof. Collie's map, using data supplied in my journal, as embodied in 'Saskatchewan and the Rocky Mountains,' and in the memory-sketch there (p. 234), in preparing which I had the advantage of some aid from Dr. Hector, a few years subsequent to my journey. My son thinks that the stream named on Prof. Collie's map, "Jonas creek," may very probably be that headwater of the Athabasca which was known to me as "Medicine Tent river" ('Sask.,' p. 193). If so, my entry to its valley might have been made near the junction of Prof. Collie's "Poboktan creek;" the fine mitre-peaked mass of "black slaty rock," which I named Mount Lindsay ('Sask.,' p. 193), being on my right as I descended a precipitous steep to gain the valley of the larger stream. The point marked "Jonas pass," might well represent (or lay near) the route I followed in crossing the divide into the Saskatchewan watershed.

Near that point my men and I erected a cairn on the top of an isolated hill of no great height ('Sask.,' p. 196). Referring to its position, I afterwards wrote, "There are two main valleys, . . . the former running north-west, the other south-east; the Medicine Tent river, an Athabasca headwater, running down the first, the North river, a Saskatchewan headwater, going down the second; the hill on which we placed the monument standing exactly at the central point where the two descents divide" ('Sask.,' p. 221). Here I may incidentally mention that when my eldest son was travelling in America a few years ago, he met at Banff (in the Rockies) a gentleman (whose name he has forgotten) who told him he had recently been among the mountains, and had seen "Southesk's cairn."

At p. 363 of the *Geographical Journal*, Mr. Wilcox states in his paper that "even the Stony Indians . . . know little of this river (North Fork)," as they do not visit that part of the country, believing that one of their tribe was "destroyed by an evil spirit." Whatever the reason, the whole district near the Medicine Tent river seemed to be utterly unfrequented, the only trace of a camp that we noticed,

during many days, being a faint vestige, which one of my men (Klyne, a French half-breed) supposed to mark a visit to those parts made by his uncle, some thirty years before. Owing to that seclusion, the valleys on either side of my cairn were swarming with wild sheep, which, if not exactly tame, showed no signs of having been much disturbed.

The explorers of this district have generally entered it from the south and travelled northwards. In my own case the process was reversed, for, following the advice of Mr. Moberly, of the Hudson Bay Company's service, I "tracked up the McLeod river," and thence westward into the mountains some way to the south of "Jasper's House." "The highest peaks, he (Mr. Moberly) informed me, rose near the point at which I should in that case enter; and southwards thence to the head of the south Saskatchewan there extended about a ten days' march of country, which, as he believed, no European had ever seen" ('Sask.,' p. 167). In my journal I afterwards refer to the fact that Indians do not frequent that district: "Perhaps superstitious reasons may keep them away, as the name Medicine Tent river indicates magic and mystery. I am the first European who has visited this valley" ('Sask.,' p. 201).

One further remark may not be out of place. Among the many drawings and descriptions of Rocky Mountain scenery in the upper Saskatchewan and Athabasca regions, it has surprised me to find no record or mention of the singular and magnificent mountains seen by me in the country that probably lies to the east of Prof. Collie's "Jonas pass." Unlike the mountains of the Medicine Tent valley, those I refer to bore the character of vast mounds of *débris* crowned by enormous parallelograms of rock with perpendicular sides some 2000 to 3000 feet high. Mount Dalhousie (the frontispiece of my book) is one of these, but its summit showed a more castellated and broken formation than that of other mountains subsequently seen in the neighbourhood, one, in particular, "resembling an immense square block of masonry, placed on the summit of a vast mound with gradual slopes, like an altar raised by giants of old to some of the extinct gods" ('Sask.,' p. 223).

SOUTHESK.

April 13, 1899.

Hannibal's Pass.

It is with regret and a certain diffidence that I find myself compelled to dissent on a point relating to the Alps from the conclusions of my most indefatigable and learned friend, the Rev. W. A. B. Coolidge. His local and historical knowledge of the chain, and more particularly of the Western Alps, is, as he has reminded your readers, unrivalled in Europe. Yet I cannot but believe that, on further reflection, Mr. Coolidge will agree with Mr. Westlake and myself that for any profitable discussion of this old-world, but not worn-out, problem of "The Pass of Hannibal," something more is required than a thorough acquaintance with the localities and the classical texts. Surely, if we do not mean to waste our time, as so many have done before us, we must bring to the task historical insight as well as historical industry. We must remember that the "texts" were once the products of human beings. We must exercise our imagination so far as to realize who the authors were, what were their characters, and what the conditions in which they lived and wrote. Thus only shall we be able to form an opinion as to what conduct may, and what may not, reasonably be imputed to them. We shall further, using still the same method, be in a better position to decide what hypotheses are, and what are not, compatible with all we know of the characteristic energies of the Roman race.

If we set aside the text of Varro, there is little difficulty in making the Mont Genèvre fit the requirements of Livy. It is not "impossible," like the Little

St. Bernard. So far I am quite at one with Mr. Coolidge. But he does not venture to set aside Varro, and I must ask students to observe carefully to what a curious treatment of the Roman author's simple sentence he is forced to resort in order to introduce any doubt as to its meaning. For clearness' sake let me quote once more Varro's catalogue of the passes:—

"*Una*, quæ est juxtà mare per Ligures,

"*Altera*, quâ Hannibal transiit,

"*Tertia*, quâ Pompeius ad Hispaniense bellum profectus est,

"*Quarta*, quâ Hasdrubal de Galliâ in Italiam venit,

"*Quinta*, quæ quondam a Græcis possessa est, quæ exinde Alpes Græciæ appellantur."

This passage, as Mr. T. W. Arnold, in his valuable and impartial summary of the whole argument ('The Second Punic War:' Macmillan, 1886), has clearly perceived, is the substantial base of my argument. Mr. Coolidge, it is true, terms it "baseless;" but the expression, in this conjunction, it would seem, is "of little meaning, though the words are strong."

For what has Mr. Coolidge to offer by way of serious reply to my argument? He writes, "It is only a theory that the passes mentioned by Varro . . . are given in topographical order." It is, on the contrary, I submit, the only reasonable interpretation. For what does any other theory assume? That a Roman general who had himself conducted campaigns in the Western Alps, a Roman scholar whose reputation was that of "veterum omnium doctissimus" (Varro was both), framed his sentences either with childish clumsiness and carelessness, or with the intent to mislead, and set a puzzle for, posterity. Nor is the need of this perverse assumption the only difficulty in Mr. Coolidge's way. He cannot but admit that Varro's first and fifth pass, the Cornice and the Little St. Bernard, are in topographical order. He will hardly, I imagine, care to argue against the conclusion, generally accepted on weighty grounds, that the pass crossed by Pompey was the Mont Genèvre. Varro, he must probably allow, mentions the Mont Genèvre also in its proper topographical order. His only doubtful passes, then, are the second and fourth. Further, we have Pompey's own statement, in a letter to the Senate (Sallust, 'Hist.,' lib. iii.), that he took a different pass from Hannibal's. How, then, can Hannibal have crossed the Mont Genèvre? Pompey's allusion to Hannibal's pass is interesting as showing how well ascertained it was considered to be at that date.

Students, therefore, who are content to follow Mr. Coolidge, have to believe that Varro, the encyclopædist and librarian of Rome in the days of Cæsar, was not only loose in his statements, but also wrong in his facts.

Enough on this crucial point. I must turn to a subsidiary matter. Mr. Coolidge has a right to urge that, apart from the text of Varro, the evidence of the use of the Mont Cenis (or some pass from the Dora Riparia valley to that of the Arc) by the Romans is "inconclusive." It is so to this extent: we possess no direct proof from monuments or documents. It is arguable that Cæsar's short cut, when he hurried to intercept the Helvetii, was not by way of the Maurienne (see *Alpine Journal*, No. 81). But we have proof that a pass in this direction was in constant use as early as the sixth century, and had by that date superseded the Mont Genèvre as the main road between France and Italy.

In order to prevent this discussion from drifting into disputable details, I will not repeat here, or even on the present occasion ask your readers to attach any weight to, the arguments drawn from the writings of earlier and local writers which I cited in the *Alpine Journal* (No. 81) as supplying indications of the existence of a road over the Mont Cenis in Roman times. For my present purpose, I am

satisfied if I can show that there was constant intercourse between Susa and the Maurienne in the sixth century. The inference I am content to leave to the common sense of geographers. Our authority for the communications across this part of the Alpine chain at that date does not seem open to any reasonable question. It is a papal bull. In volume sixteen of the *Gallia Christiana*, students will find the legend of the foundation of the See of the Maurienne, as well as its early history. In the middle of the sixth century, Tigris, a pious lady of the Maurienne, *was in the habit of receiving strangers and pilgrims.* Amongst her guests were a company of Scottish palmers from the Holy Land, who fired the good lady's imagination by tales of where the relics of St. John the Baptist were to be found to such good purpose that she set off for the East, and succeeded in recovering a thumb and depositing it in a church on the spot since known as St. Jean de Maurienne. Gontran, King of Burgundy, thereon founded a bishopric of the Maurienne (A.D. 562). This date is generally accepted. So far the legend told at length in a tenth-century MS., preserved in the National Library at Paris, and contemporaneously by Gregory of Tours in his 'De Gloriâ Martyrum,' c. 13.* After A.D. 562 we come on more solid ground. In A.D. 596 Gregory the First addressed to Theodoric, King of Burgundy, and Theodebert, King of Austrasia, a Bull complaining that the See of Turin had been materially curtailed and injured by the establishment of the Maurienne bishopric. It would seem that the valley of the Arc had been under the ecclesiastical jurisdiction of Turin till the latter part of the sixth century, and that subsequently Susa came under the bishopric of the Maurienne. Anyhow, the papal remonstrance failed to have any effect, and 130 years later we find the great monastery of Novalese founded with the consent "pontificum et clericorum nostrorum Mauriennatæ et Segusinæ civitatum," and that the same bishop was enthroned in the churches of St. John the Baptist of the Maurienne, and our Lady of Susa.

It can hardly be needful to point out the importance of these records for my purpose. They indicate a long-established and frequent use of one or more of the passes connecting the valleys of the Arc and the Dora Riparia at an early period. In my opinion, however, such documentary evidence as we possess on this matter is not essential. It is surely hard to believe that one of the principal and, from the East, most conspicuous gaps in the Western Alps, where the chain sinks into broad and rich pastures—the *Alpes in Cenisio* of early documents—was unknown to the neighbouring tribes.† It is wholly inconceivable to me that the practicable pass which from Carlovingian times onwards has been the most frequented in the Western Alps—a pass lying within a morning's walk of a flourishing Roman town (how flourishing Susa was is amply shown in Mommsen's 'Corpus Inscriptionum,' vol. v.)—was undiscovered and unused by its inhabitants. Such a supposition, I venture to think, is entirely contrary to the genius of the Roman race. Neither the silence of the surviving Itineraries as to the Mont Cenis (and its variations), nor the failure, up to the present time, of local antiquarians to produce any milestones from it, can overcome, or even shake, my conviction on this point. No doubt for some centuries the Mont Genèvre was the main high-road over the Western Alps. But that there was no known passage to the valley of the Arc is more than I can believe.

I am quite prepared, however, to be told that I place imagination in the place of fact; that all I prove thereby is that I have not the frame of mind, or the method,

* See also the 'Eclaircissements et Observations,' pp. 399–407, of Bordier's edition of the works of Gregory of Tours. Paris: Renould & Cie., 1857.

† Simler has some very sensible and apposite remarks bearing on this point in the chapter on Passes in his 'De Alpibus Commentarius,' A.D. 1574.

requisite to render my opinion of any value on a matter proper to antiquarians. Possibly, however, my experience as a traveller has given me one advantage over some more learned disputants. I can refer to a parallel case. Substituting Russians for Romans, the Caucasus is—or rather has been during the last half-century—very much in the position of the Alps at the beginning of our era. Besides the great high-road, there are several passes over the chain not furnished with stations or verst-posts, or indicated in general maps of the empire, yet well known locally and freely used. There are also passes which Russian forces have traversed which have not been converted into roads. I may cite as specific instances of each class the Klukhor and the Marukh (see *Petermann's Mitteilungen*, No. 12, 1898, with regard to the latter pass).

After all, the possibility of Hasdrubal having crossed the Mont Cenis does not in any way depend on the date of the establishment of a high-road over it by the Romans or their successors. Nature made the pass, and since the mountains were brought forth there has been a practicable gap in them at this spot ready for human use.

Before leaving this branch of the subject, the claims of the Mont Cenis to have been a Roman pass, I may refer students to a monograph of sixty pages by Prof. Dr. Osiander, 'Der Mont Cenis bei den Alten' (Cannstatt, 1897), which contains all—and much more than all—that can properly be urged in support of the antiquity of the pass. The learned writer, while citing a mass of interesting authorities, seems to me to pervert the well-known classical texts in a quite inadmissible fashion in order to force them into accordance with his own views. In my opinion he has injured a good case by unsound arguments, and I am sorry to have him for a supporter on this point. On the main question, however, we are at variance. He conducts Hannibal over the Mont Cenis.

In his second comment on Mr. Westlake's note, Mr. Coolidge has been somewhat hasty, and has consequently misunderstood the argument. "The Pass of the Argentière" is obviously used by Mr. Westlake (as it was used by Brockedon in his classical 'Passes of the Alps') as a term covering all the part of the route that lies in the mountains down to the point where it quits them. San Dalmazzo lies "at the foot" of the pass in the same sense that Chiavenna, Bellinzona, Domo d'Ossola, and even Verona are said to lie at the foot of the Alpine passes. Mr. Coolidge himself ('Alpine Guide,' chap. 1, rte. A.) describes San Dalmazzo as "a large village at the *very foot* of the mountains." The "rich plains" referred to by Mr. Westlake are those that lie parallel with the mountains between Borgo San Dalmazzo and Turin, a distance of 60 miles. His point, of course, is that these afford space, and the 7 miles of plain between Rivoli and Turin do not, for the successive incidents described by the historians.

Mr. Coolidge's reference to Prof. Fuchs' "small tractate" also requires some correction. That closely printed volume of 152 pages is "based on personal investigations on the spot" as regards the Mont Genèvre. But I can find in it no sign that the author has considered the text of Varro, or has ever visited, or even heard of, the Col de l'Argentière (which he calls on his map the Col della Maddalena); while so far is he from "having a full knowledge of all the (modern) literature," that he has not referred to Prof. Schiller's, Mr. T. W. Arnold's, or my own writings* on the subject. Moreover, he constantly speaks of "the English" collectively as partisans of the Little St. Bernard, as if the late Mr. Ball, Mr. Bunbury, and Prof. Bonney had never expressed the contrary view.

* 'Berliner Philologischer Wochenschrift,' June, 1884; 'The Second Punic War' (Macmillan, 1886); *Alpine Journal*, vols. xi. and xiii., Nos. 81 and 93; and *Proceedings R.G.S.*, October, 1886.

I have not, I readily admit, Mr. Coolidge's detailed knowledge of the more obscure passes of the Western Alps. But I fail to see that a complete or partial acquaintance with impossible passes is any additional qualification for deciding which of the possible passes was used by the Carthaginian army. Mr. Coolidge's convictions are always forcibly expressed, interesting, and worthy of full consideration, but he must pardon me for saying that they do not present themselves to me as conclusive for the rest of the world. I have myself crossed all the five great passes which now, as in Varro's days, unite Gaul and Italy. I see no reason to modify the opinion I came to sixteen years ago. We cannot ourselves prove which pass Hannibal crossed; but we can show where the best informed Romans of Cæsar's time knew, or thought they knew, him to have crossed.

Finally, should Mr. Westlake, or any other reader, accept Mr. Coolidge's invitation to refer to his new edition of the 'Alpine Guide,' he will, I think, find much comfort and support in the following sentences. Mr. Coolidge there writes (section 3, rte. A., Western Alps): "It was the passage of Francis I. in 1515 with a large army that first brought the Col de l'Argentière into historical prominence. It was later traversed by French and Spanish armies in 1692, 1710, and 1744. Napoleon ordered a road to be made over it bearing the proud title of 'Route Impèriale de l'Espagne en Italie;' and even now (though that project has not yet been fully carried out) it is styled the road 'from Montpellier to Coni' (Cuneo). It is, perhaps, the gentlest and easiest pass in the whole of the Western Alps, and has been compared to the road between Keswick and Ambleside."

It follows from these statements, that the physical features of the country are consistent with the Roman belief that the Col de l'Argentière was crossed by Hannibal, that the pass is the most natural route from Spain to Italy for an army and that several armies have used it, meeting on the way with adventures and difficulties coinciding in a very remarkable way with those attributed to Hannibal (see my paper, *Alpine Journal*, No. 81). All this we find established on Mr. Coolidge's own showing. The advocates of the Col de l'Argentière could hardly have hoped for such powerful testimony to the strength of their case from a sturdy opponent.

It may, perhaps, be agreeable to those readers who are familiar with the almost fabulous pertinacity in argument which characterizes the majority of the disputants in this matter, if I assure them that I do not propose, under any provocation, to intrude my own views on their patience any further in these pages. An English writer of authority has, I find, been lately kind enough to speak of my early papers, an analysis of which appeared in the Society's *Journal*, as "epoch-making!" So handsome a compliment may possibly justify me in revising and re-issuing them in a separate form at some future date.

DOUGLAS W. FRESHFIELD.

Ophir.

Though Dr. Schlichter is very likely right in his contention that Ophir was not in India, I venture to think that the grounds on which he has arrived at his conviction will scarcely stand examination. Bearing in mind what we know as to the actual facts at a later period of the history of India, it seems impossible to admit the trustworthiness of Arrian's account of the scarcity, or absence, of gold in those provinces which came under the observation of Alexander and his companions; not to mention that Q. Curtius has quite a different story to tell. We read that a thousand years after the Greek expedition, Arab conquerors found in the Panjab, and in that very capital of the Malli which Alexander so gallantly stormed, and

where he so nearly lost his life, an immense treasure of gold (gold-dust). Muhammad bin Qasim, the Arab leader, is reported to have sent to Iráq 120 millions of *dirhams*, by far the greater part of which must have been derived from the spoils of Multan. Another account puts the Multan treasure at 40 *buhár*, a vague measure which sometimes meant a camel-load, but the same writer, expressing the amount in different terms, calls it 2,397,600 *mithqál* (a gold coin said to weigh 1½ dram). We may make large allowance for Eastern exaggeration and yet fairly conclude that the quantity of gold found in this one temple treasury was enormous. No doubt vast changes, economic as well as political, may occur even in Asia in the course of a millennium, but we cannot, I believe, gather either from tradition or recorded history, anything to favour the supposition that gold flowed into India in abnormal amount in the interval between the Macedonian and the Arab invasions. On the contrary, the facts of which we have sufficient evidence—the absence of settled and vigorous government, the frequent invasions and harryings of the regions in which Multan itself formed a central point, during the period in question—must convince us that the accumulation of gold where it was formerly unknown is not to be thought of as possible.

Not much can be gained from the study and comparison of the place-names involved in the Ophir controversy. The mysterious port or region is called in Genesis Ophir, and in later books of the Old Testament Ophír (*i* long). The LXX. transliterated Σωφηρα, Σωφειρα, Ωφειρ, and in one place the Alexandrine Codex has Σωφαρα. The last variant agrees closely with Sofala, but equally closely with Súpárá, north of Bombay, an emporium of great antiquity, which was flourishing centuries before Zimbabwe came into existence, supposing Dr. Schlichter's date for the latter's foundation to be correct. As for Lassen's identification of Ptolemy's Αβιρια with Ophir, it is sufficient to recall the fact that Ptolemy places that district north of Patalene, or the Indus delta region—that is, at a considerable distance from the sea—to put it out of the question. Any place in Arabia seems to be excluded by the length of the voyage, which is postulated as a condition in the controversy, otherwise Ophír near Sohár, in the province of Oman, would be suitable, for though none of the articles mentioned as forming part of Solomon's cargoes were of Arabian production, all might have been found in an Arabian port.

Nor, again, can anything conclusive, as between Africa and India, be derived from a consideration of the length of the voyage. Keeping in mind the fact that the navigation of the time was still in the stage of coasting (Hippalus being still in the womb of the distant future), it is clear that a voyage from Ezion Geber to any port in Southern India would take as much time as one to Sofala.

I venture to think that Dr. Schlichter should apply himself to the refutation (if that be possible) of Josephus' express statement that Solomon sent his men "to the land that was of old called *Ophir*, but now the *Aurea Chersonesus* which belongs to India;" and should also take into consideration the fact that Coptic lexicographers have declared "Ophir" in their language to mean India. Very likely Josephus, though learned, was not profound in geography, but it is not at all improbable that he had inherited a truthful tradition. Also both he and the Copts perhaps spoke of India much as people used to speak of "The Indies," which might or might not include India proper. At all events, if Josephus knew anything about it, Ophir was in the Malay peninsula or thereabouts.

M. R. Haig, Major-General.

April, 1899.

P.S.—Dr. Schlichter is quite correct in saying that El Mas'udí mentions Sofala. He speaks of it in connection with the people called *Wáq Wáq*, and says it produced abundance of gold.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1898-99.

Eighth Ordinary Meeting, March 27, 1899.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Alexander d'Abaza; Andrew Walker Bell; C. R. S. Cadells; Wm. Young Campbell; George Drury Coleman; George Griffin Eady; William Mason.*

THE NATIONAL ANTARCTIC EXPEDITION. MR. L. W. LONGSTAFF'S DONATION.

After the statement made by the President which was published in the April number of the *Journal*, the PRESIDENT said: We are honoured this evening by the presence of Lord Lister, President of the Royal Society, who will wish also to say a few words on the munificence of our associate.

Lord LISTER: It gives me peculiar gratification to be present this evening, on which the President of the Geographical Society has made an announcement which has pleased you all so much. The Royal Society has, of course, taken a deep interest in the project of an antarctic expedition, but the funds at her disposal for scientific purposes are but slender, and she has been able to do not much in that line. The Geographical Society, as a Society, has done more, and your President deserves the thanks of us all for his energetic and successful efforts, crowned as they have been by the acquisition of this splendid donation you have heard of. A British Antarctic Expedition is now assured, and the disgrace that would have been attached to this country if she had not risen to the present important occasion, is prevented.

I need hardly say how deeply grateful all of us feel to the donor of this great gift. I must confess that it is to me a matter of satisfaction that he is the son of a distinguished member of the medical profession. I don't know whether Lord Iveagh's magnificent gift to the Jenner Institute of Preventive Medicine can have had any influence in suggesting to Mr. Longstaff that he might do likewise. We can only hope that donations of this splendid kind for the furtherance of science will be abundant in the future.

We cannot expect our Government to do very much for us in the aid of science; but so long as we have such donations from private individuals, science will get on very well. It only remains now to endeavour to induce the Government to aid the expedition, the full expense of which, whether rightly or wrongly, they did not feel prepared to undertake.

I cannot sit down without congratulating the Geographical Society on the splendid success they have attained.

The PRESIDENT: I am sure, after what you have heard, you will wish to pass a cordial vote of thanks to Mr. Longstaff for his munificent gift, and you will be glad that I should inform him of your vote.

The Paper read was:—

"On Kumatology." By Vaughan Cornish, Esq.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce, Commercial.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
M. = Mitteilungen.
Mag. = Magazine.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue, Revista.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Austria. *Z. Ges. Erdk. Berlin* **33** (1899): 355–366. **Richthofen.**

Die neue geologische Karte von Oesterreich. Von F. v. Richthofen.

Austria—Bukovina. *Globus* **74** (1898): 381–387. **Hormuzaki.**

Aus dem Gebirge der Bukowina. Landschafts und Vegetations-Skizzen. Von C. Frhrn. v. Hormuzaki. *With Illustrations.*

The illustrations are from sketches. A notice appears in the *Journal*, p. 529.

Austria-Hungary—Carpathians. **Dénes.**

Jahrb. Ungar. Karpathen-V. **25** (1898): 121–143.

Die neue Originalkarte der Hohen-Tátra. Von Franz Dénes.

Austria-Hungary—Carpathians. **Filarszky.**

Jahrb. Ungar. Karpathen-V. **25** (1898): 30–91.

Das Pieninen-Gebirge und seine Flora. Von Dr. Ferdinand Filarszky.

Azores. *Tour du Monde* **4** (1898): 625–636. **d'Espagnat.**

Aux iles Açores. Par M. Pierre d'Espagnat. *With Illustrations.*

Balkan Peninsula. *Deutsche Rundschau G.* **21** (1899): 193–206, 255–266. **Meinhard.**

Auf Transbalkanbahnstudien. Von Friedrich Meinhard. *With Illustrations and Map.*

Belgium. *Globus* **75** (1899): 21–24. **Kellen.**

Arel, eine deutsche Stadt in Belgien. Von Tony Kellen. I.

Bulgaria—Rila Mountains. *Scottish G. Mag.* **15** (1899): 86–92. ——

The Rila Mountains.

Denmark—The Sound. **Lönnberg.**

Undersökningar rörande Öresunds Djurlif. Af Dr. Einar Lönnberg.—Meddelanden från Kongl. Landtbruksstyrelsen. No. I. år 1898. (No. 43.) Uppsala, 1898. Size 9½ × 6½, pp. 78. *Map.*

An account of the biological conditions of the waters of the Sound, with lists of species.

England and France. *Sitzb. A. W. Berlin* (1898): 859–892. **Lohmann.**

Die Amtliche Handelstatistik Englands und Frankreichs im xviii. Jahrhundert. Von Dr. Friedrich Lohmann.

Europe—Continental Shelf. *Geolog. Mag.* 6 (1899): 16–18. **Spencer.**

Prof. Hull's 'Submerged Platform of Western Europe.' By Prof. J. W. Spencer. Also letter by Rev. Osmond Fisher, pp. 56–57.

Europe—Geodesy. **Weiss and Schram.**

Publicationen für die Internationale Erdmessung. Astronomische Arbeiten des k. k. Gradmessungs-Bureau ausgeführt unter der Leitung des Hofrathes Theodor v. Oppolzer. Nach dessen Tode herausgegeben von Prof. Dr. Edmund Weiss und Dr. Robert Schram. X. Band. Längenbestimmungen. Wien: F. Tempsky, 1898. Size 12½ × 10, pp. 286. *Presented by the K. K. Gradmessungs-Bureau in Wien.*

Contains a number of determinations of time-intervals between important continental observatories.

Faroe Islands. *Die Natur* 47 (1898): 519, 529, 543, 555, 567, 583. **Lorenzen.**

Die Fär-Öer. Nach J. Lomholt in "Nord og Syd." Von A. Lorenzen.

Germany. *Globus* 75 (1899): 89–96, 108–114, 143–149. **Tetzner.**

Die Kuren in Ostpreussen. Von Dr. F. Tetzner. *With Map and Illustrations.*

On the people of Russian Kurland now concentrated on the long narrow sandspit of the Kurische Nehrung.

Germany. **Ratzel.**

Deutschland. Einführung in die Heimatkunde. Von Friedrich Ratzel. Leipzig: F. W. Grunow, 1898. Size 7½ × 4½, pp. viii. and 332. *Maps and Illustrations. Price* 2*s.* 6*d.*

The author writes with the object of deepening the knowledge of Germany amongst the people of that country, and he points out that this can only be done satisfactorily by demonstrating how closely the life of the people depends on the character of the land.

Germany—Alsace. **Reuss.**

L'Alsace au dix-septième siècle au point de vue géographique, historique, administratif, économique, social, intellectuel et religieux. Par Rodolphe Reuss. Tome Deuxième. Paris: E. Bouillon, 1898. Size 10 × 6½, pp. xii. and 638. *Price* 16*s.*

Germany—Commercial Geography. **Gastrell.**

Development of Commercial, Industrial, Maritime, and Traffic Interests in Germany, 1871 to 1898. Foreign Office, Miscellaneous, No. 490, 1899. Size 10 × 6½, pp. 72. *Price* 1½*d.*

This is a valuable chapter on the Commercial Geography of Germany, sketching the great strides of advance which have been made since the foundation of the empire.

Germany—Hiddensöe. *Globus* 75 (1899): 9–14. **Seidel.**

Spaltenbildungen und Landverlust auf Hiddensöe. Von H. Seidel. *With Map and Illustrations.*

On the loss of land on the Baltic island of Hiddensee on the west side of Rügen.

Germany—Meteorology.

Ergebnisse der Beobachtungen an den Stationen II. und III. Ordnung im Jahre 1898, zugleich Deutsches Meteorologisches Jahrbuch für 1898 Beobachtungssystem des Königreichs Preussen und benachbarten Staaten.—Veröffentlichungen des k. Preussischen Meteorologischen Instituts 1898, Heft 1. Berlin: A. Asher & Co., 1898. Size 13½ × 10.

Germany—Meteorology.

Ergebnisse der Beobachtungen an den Stationen II. und III. Ordnung im Jahre 1894, zugleich Deutsches Meteorologisches Jahrbuch für 1894 beobachtungssystem des Königreichs Preussen und benachbarten Staaten.—Veröffentlichungen des königlich Preussischen Meteorologischen Instituts. Herausgegeben durch dessen Direktor Wilhelm von Bezold, 1894, Heft III. Berlin: A. Asher & Co., 1898. Size 13½ × 10. *Map. Presented by the K. Preussischen Meteorologischen Instituts.*

Germany—Schleswig. *Globus* 75 (1899): 53–54.

Die Nationalitätsverhältnisse in Schleswig. *With Map.*

The map shows the districts in which Frisian, Danish, German, and both German and Danish are spoken.

Germany—Silesia. **Hellmann.**

Regenkarte der Provinz Schlesien. Mit erläuterndem Text und Tabellen. In amtlichem Auftrage bearbeitet von Prof. Dr. G. Hellmann. Berlin: D. Reimer, 1899. Size 10½ × 7, pp. 24. *Map. Presented by the German Meteorological Institute.*

Historical. **Rey.**

Le Royaume de Cottius et la Province des Alpes Cottiennes d'Auguste á Dioclétien. Par R. Rey. Grenoble: A. Gratier & Cie., 1898. Size 9 × 6, pp. 250. *Maps. Price* 6*s.* 6*d.*

Holland—Geology. **Cappelle.**

Mededeelingen omtrent de Geologie van Nederland, Verzameld door de Commissie voor het Geologisch Onderzoek. No. 23. Nieuwe Waarnemingen op het Nederlandsche Diluviaalgebied, voornamelijk met het oog op de Kaarteering dezer terreinen. Door Dr. H. van Cappelle. Verhandelingen der k. Akademie van Wetenschappen te Amsterdam. (Tweede Sectie.) Deel vi. No. 2. Amsterdam: J. Müller, 1898. Size 11 × 7½, pp. 24. *Plate.*

Notes on the boulder-clay deposits of Holland.

Hungary. *Die Natur* **47** (1898): 505–509. **Woenig.**

Die Pusztenflora des ungarischen Tieflandes. Studien-Skizzen von Franz Woenig. 4. Die Flora der Salz-Puszten, Salzseen, Salzlachen, und der Salzauswitternden Stellen des Bodens.

Iceland. *Z. Ges. Erdk. Berlin* **33** (1898): 283–301. **Thoroddsen.**

Untersuchungen in Island in den Jahren 1895 bis 1898. Von Dr. Th. Thoroddsen.

Italy. ———

Suggestions for Development of British Trade with Italy. Foreign Office, Miscellaneous, No. 490, 1899. Size 10 × 6½, pp. 20. *Price* 1½*d.*

Italy. **Magistris.**

Giovanni Marinelli. Le Provincie d'Italia. Provincia di Massa e Carrara di Luigi Filippo de Magistris. Roma: Società Editrice Dante Alighieri, 1898. Size 8 × 5½, pp. 20. *Presented by the Author.*

Italy. **Baedeker.**

Italy. Handbook for Travellers by Karl Baedeker. First Part: Northern Italy, including Leghorn, Florence, Ravenna, and routes through Switzerland and Austria. With 25 Maps and 35 Plans. Eleventh edition. Leipsic: Karl Baedeker; London: Dulau & Co. 1899. Size 6½ × 4½, pp. lxiv. and 540. *Price* 8 *marks. Presented by Messrs. Dulau & Co.*

Italy—Geology. *Atti R.A. Lincei, Rendiconti* **7** (2 Sem.) (1898): 326–330. **Lorenzo.**

I grandi laghi pleistocenici delle falde del Vulture. Nota preliminare di G. De Lorenzo.

Mediterranean. *Ann. Hydrographiques* (1898): 35–37. **Grenet.**

Remarques sur le régime des vents de la côte Nord de la Méditerranée. Par M. Victor Grenet.

Mediterranean—Alboran. **[Ludwig Salvator.]**

Alboran. Prag: H. Mercy Sohn, 1898. Size 13 × 10½, pp. viii. and 90. *Maps and Illustrations. Presented by the Archduke Ludwig Salvator.*

H.I.H. the Archduke Ludwig Salvator observes in his preface that probably no island in the world is seen by so many and visited by so few as Alboran. The island, which carries an important lighthouse, lies 100 miles east of Gibraltar, midway between the coasts of Spain and Marocco.

Mediterranean—Lampedusa. **Magistris.**

La pesca delle spugne nel mar di Lampedusa durante l'anno 1896. [L. F. de Magistris.] (Estratto dal Giornale Italiano di Pesca e Acqui-coltura, N. 1.—1898.) Size 10 × 7, pp. [4]. *Presented by the Author.*

Norway. **Dahl.**

Botaniske undersøgelser i Søndfjords og Nordfjords fjorddistrikter i 1896-97. Af Ove Dahl. Christiania, 1898. Size 9½ × 6½, pp. 72.

Norway. **Oppenheim.**

New Climbs in Norway. An Account of some Ascents in the Sondmore District. By E. C. Oppenheim. Illustrated by A. D. McCormick, and from Photographs. London: T. Fisher Unwin, 1898. Size 8½ × 6, pp. x. and 258. *Price* 7*s.* 6*d. Presented by the Publisher.*

Describes mountaineering exploits which carried the author and his friends into some of the still almost unvisited parts of Norway.

Norway and Sweden. *Questions Dipl. et Colon.* **5** (1898): 409–412. **Koht.**

Norvège et Suède. Par Halvdan Koht.

Russia. *Globus* **75** (1899): 130–132. **Nehring.**

Gab es einst Wälder in der Kalmückensteppe? Von Prof. Dr. A. Nehring.

A discussion of the probable existence of woods in the Kalmuk steppe from the evidence of animal fossils. The paper is noticed in the *Journal* for April, p. 429.

Russia. **Toll.**

Geologische Forschungen im Gebiete der Kurländischen Aa. von Baron E. von Toll. Vorläufiger Bericht mit einem Anhange, Dr. Gunnar Andersson's Verzeichniss der Glacialpflanzen von Tittelmünde enthaltend. (Separat-Abzug aus den Sitzungsberichten der Naturforscher-Gesellschaft bei der Universität Jurjew (Dorpat). Jhrg. 18.) Size 8½ × 5½, pp. 34. *Presented by the Author.*

Spain. *Deutsche Rundschau G.* **21** (1898): 103–108. **Nebehay.**

In Baskenlande. Von Karl Nebehay. *With Illustrations and Plans.*

A visit to the north of Spain, including Bilbao and San Sebastian.

Spain—Llivia. *A travers le Monde, Tour du Monde* **5** (1899): 21–22. ——

L'Enclave de Llivia. *With Map.*

Llivia is a small *enclave* of Spanish territory in the French department of Pyrénées Orientales, with a neutral road about a mile in length, connecting it with the main body of Spain.

Switzerland. *Mouvement G.* **15** (1898): 607–612. **Wauters.**

Le Chemin de fer du Gornergrat. *With Illustrations.*

United Kingdom. *J. School G.* **2** (1898): 361–369. **Buchan.**

The Temperature of the British Isles. By A. Buchan, LL.D.

ASIA.

Asia—Historical. *Sitzb. A. W. Berlin* (1898): 824–843. **Köhler.**

Das asiatische Reich des Antigonos. Von Ulrich Köhler.

China. ——

China. Imperial Maritime Customs. II.—Special Series: No. 2, Medical Reports, for the half-year ended March 31, 1898. Shanghai. London: P. S. King & Son, 1898. Size 11 × 9, pp. vi. and 58. *Diagrams and Illustrations.*

China. ——

China. No. 1 (1899). Correspondence respecting the Affairs of China. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. xxiv. and 360. *Price* 3*s.*

This Bluebook contains the correspondence of the Foreign Office relating to Chinese affairs from March 29, 1898, to February 3, 1899, in all 473 documents.

China. *Questions Dipl. et Colon.* **6** (1899): 83–87. **Fauvel.**

Les Télégraphes et les Postes en Chine. Par M. A. A. Fauvel. *With Map.*

China. *Deutsche Rundschau G.* **21** (1899): 220–223. **Karsten.**

Ein Blick in das Industrieleben Chinas. Von Paula Karsten.

Chinese Empire—Tibet. *Oesterr. Monats. Orient.* **24** (1898): 135–138. ——

Landor's Reise in Tibet.

Chinese Empire—Turkestan and Tibet. **Grenard—Dutreuil de Rhins.**

J. L. Dutreuil de Rhins. Mission scientifique dans la Haute Asia, 1890–1895. Deuxième Partie. Le Turkestan et le Tibet, étude ethnographique et sociologique. Par F. Grenard. Paris: E. Leroux, 1898. Size 11½ × 9, pp. 476. *Illustrations. Presented by the French Minister of Public Instruction.*

French Indo-China—Annam. **Lemire.**

Bijd. Taal-, Land- en Volkenk. Ned.-Indië **6** (1899): 76–86.

Excursion à Hué, capitale de l'Annam. Par Ch. Lemire.

French Indo-China—Tonkin. **Billet.**

Deux Ans dans le Haut-Tonkin (Région de Cao-Bang). Par le Dr. Albert Billet. Paris: A. Challamel, 1898. Size 10 × 6½, pp. lv., 326, and xliv. *Maps and Plates. Price* 20*s.*

This work was originally published in the *Bulletin Scientifique de la France et de la Belgique.* It gives a detailed account of the Cao-Bang district in all aspects, and supplementary chapters on the fauna and flora of Upper Tonkin. It represents two years of very arduous scientific work, concisely told.

India. ———

Report on the Madras Observatory for the year 1897-98, and on the Eclipse Expedition of January, 1898. Madras, 1898. Size 10 × 6½, pp. 30.

India. **Hunter.**

A History of British India. By Sir William Wilson Hunter, K.C.S.I., etc. Vol. i. To the overthrow of the English in the Spice Archipelago. London: Longmans & Co., 1899. Size 9½ × 6, pp. 476. *Maps. Price* 18*s. Presented by the Author.*

This first volume of a new and comprehensive history of British India commences with the closing of the old trade-routes to the East, recounts the quest for India by sea, and traces the history of the struggle of the Portuguese and Arabs for supremacy, the constitution of the first English East India Company, and the struggle with the Portuguese, and the volume ends with the tragedy of Amboyna in 1623.

India. *P.I. Civil Engineers* **134** (1898): 66–118. **Stoney.**

Extraordinary Floods in Southern India: their Causes and Destructive Effects on Railway Works. By E. W. Stoney. *With Plate.*

India—Andaman Islands. *J.S. Arts* **47** (1899): 292–305. **Temple.**

The Penal System at the Andamans. By Colonel Richard Carnac Temple.

India—Assam. **Home.**

Progress Report of Forest Administration in the Province of Assam for the year 1896-97. (From July 1, 1896, to June 30, 1897.) By A. L. Home. Calcutta, 1897. Size 13½ × 8½, pp. 98 and 4. *Map.*

India—Bombay Presidency. ———

Brief Sketch of the Meteorology of the Bombay Presidency for 1897-98. Size 13½ × 8½, pp. 16. *Diagram.*

India—Burma. *J. S. Arts* **47** (1899): 173–190. **Nisbet.**

Railways in Burma, and their proposed extension across Yunnan. By John Nisbet. *With Maps.*

India—Burma. **Pottinger and Prain.**

A Note on the Botany of the Kachin Hills north-east of Myitkyina. By E. Pottinger and D. Prain.—Records of the Botanical Survey of India. Vol. i. No. 11. Calcutta, 1898. Size 10 × 6, pp. 215–310. *Maps. Presented by Captain E. Pottinger.*

India—Burma. *M.G. Ges. Wien* **41** (1898): 664–705. **Schmitz.**

Burma, die östlichste Provinz des indischen Kaiserreiches. Nach englischen Quellen und eigenen Beobachtungen von. Dr. H. Schmitz. *With Map.*

India—Chitral. **Robertson.**

An Official Account of the Chitral Expedition, 1895. Compiled . . . by Captain W. R. Robertson. Calcutta, 1898. Size 13½ × 8½, pp. 94 and cxviii. *Maps and Illustrations.*

This important report includes a history of British relations with Chitral, as well as the detailed description of the proceedings of the relief expedition in 1895.

India—Corundum. **Holland.**

A Manual of the Geology of India. Economic Geology. By the late Prof. V. Ball, C.B. Second Edition, revised in Parts. Part I.—Corundum. By T. H. Holland. Calcutta, 1898. Size 10½ × 7½, pp. 80. *Maps and Plate. Price* 1*s.* 4*d.*

On the distribution of corundum in its common form valuable as abrasive material, and in its precious form as ruby, sapphire, and oriental topaz, with numerous maps and full particulars of the method of occurrence.

India—Railways. **Brereton.**

Administration Report on the Railways in India for 1897-98. By A. Brereton. London: Eyre & Spottiswoode, 1898. Size 13½ × 8½, pp. xxvi., 218, and xlviii. *Map and Diagram. Price* 3*s.* 2*d.*

The total length of Indian railways open or sanctioned on March 31, 1898, was 25,454½ miles, of which over 21,150 miles were open for traffic.

India—Wrecks. **Falle.**

Return of Wrecks and Casualties in Indian Waters for the year 1897. Prepared by Commander P. J. Falle. Calcutta, 1898. Size 13 × 8½, pp. 62. *Map and Diagram. Presented by Commander P. J. Falle.*

Indian Ocean—Christmas Island. **Andrews.**

A Description of Christmas Island (Indian Ocean). By Chas. W. Andrews, B.SC. From the *Geographical Journal* for January, 1899. Size 10 × 6½, pp. 24. *Map and Illustrations.*

Indo-China. *B.S.G. Paris* **19** (1898): 261–290. **Bel.**

Mission au Laos et en Annam (Annam, pays Khas, Bas-Laos). Par J. M. Bel. *With Map and Illustrations.*

Indo-China. *Ann. G.* **8** (1899): 49–61. **d'Anty.**

Relation d'un voyage dans la région située au sud de Semao. Par M. P. Bons. d'Anty. *With Map and Illustrations.*

Journeys on the frontier region of China in the Mekong basin by the French Consul at Semao, in Yunnan.

Indo-China. *Questions Dipl. et Coloniales* **5** (1898): 449–457. **Lanessan.**

Les Chemins de fer de l'Indo-Chine et de la Birmanie. Par J. L. de Lanessan. *With Map.*

Indo-China. *Rev. Française* **24** (1899): 46–51. **Servigny.**

Indo-Chine: Les Chemins de fer projetés. Par J. Servigny. *With Map.*

Shows the existing Burmese lines, and the routes of projected railways from Burma and French Indo-China into Southern China.

Indo-China—Laos. *B.S.G. Lyon* **15** (1899): 327–332. **Massieu.**

Voyage au Haut-Laos. Par Mme Isabelle Massieu.

Malay Peninsula. *M.G. Ges. Wien* **41** (1898): 706–713. **Rowland.**

Bemerkungen über einen kleinen Stamm von Orang Bukit, zur Zeit angesiedelt und beobachtet auf Perhentian Tingi Estate, Negri Sembilan, Mai—September 1896. Von W. R. Rowland.

Particulars regarding a small clan of thirty individuals belonging to one of the tribes of Negri-Sembilan which numbers two hundred.

Russia—Siberia. *Contemporary Rev.* **75** (1899): 248–262. **Cobbold.**

A Trip to Lake Balkash. By R. P. Cobbold.

Russia—Siberia. *XXVI. Jahresb. Ver. Erdk. Dresden* (1898): 54–57. **Huth.**

Die Tungusen. Von Dr. Georg Huth.

Russia—Siberia. *Deutsche Rundschau G.* **21** (1898–99): 97–103, 171–175. **Studnicki.**

Das Klima Sibiriens. Von Ladislaus Studnicki.

This paper deals with the Siberian climate and its influence on vegetation.

Russian Central Asia. **Krahmer.**

Russland in Asien. Band. II. Russland in Mittel-Asien. Von Krahmer. Leipzig: Zuckschwerdt & Co., 1898. Size 9½ × 6½, pp. iv. and 182. *Illustrations. Price* 4*s.* 6*d.*

AFRICA.

Africa—Climate.

The Climatology of Africa—Seventh Report of a Committee of the British Association for the Advancement of Science (Bristol, 1898). Size 8½ × 6, pp. 8. *Presented by the Secretary of the Committee.*

Africa—Leo's Work. **Schefer.**

Recueil de Voyages et de Documents pour servir à l'Histoire de la Géographie depuis le XIIIe. jusqu'à la fin du XVIe. siècle. [Vol. xv.] Description de l'Afrique tierce partie du Monde escrite par Jean Leon African. Premièrement en langue Arabesque, puis en Toscane et à présent mise en François. Nouvelle Édition annotée par Ch. Schefer. Troisième Volume. Paris: E. Leroux, 1898. Size 11 × 7¼, pp. xiv. and 480. *Price* 21*s.*

Algeria. *Questions Dipl. et Colon.* **6** (1899): 193–205. **Bernard.**

La Situation politique de l'Algérie. Par M. Augustin Bernard.

Algeria—Coral. *Rev. Scientifique* **11** (1899): 74–78. **Layrle.**

La pêche du corail en Algérie. Par M. Layrle.

British Central Africa.

The Livingstonia Mission (British Central Africa), with Report for 1897-98. Size 9 × 5½, pp. iv. and 90. *Map.*

British and German East Africa. *Mouvement G.* **16** (1899): 115–116. ——

Entre les lacs Nyassa et Tanganika. Délimitation des sphères d'influence anglaise et allemande. *With Map.*

British South Africa. *J.S. Arts* **47** (1899): 209–224. **Wilkinson.**

Rhodesia and its Mines in 1898. By William Fischer Wilkinson. *With Maps and Sections.*

British South Africa. **Thomson.**

Rhodesia and its Government. By H. C. Thomson. London: Smith, Elder & Co., 1898. Size 8½ × 5½, pp. xii. and 352. *Map and Illustrations. Price* 10*s.* 6*d. Presented by the Publishers.*

A careful study of the actual conditions of the British South Africa Company's territories and of their administration. Most of the facts mentioned were observed by the author when in the country; the opinions were formed after consulting with a number of experienced people of all classes of the South African community. Suggestions are made as to the proper way of dealing with the natives.

British West Africa—Gold Coast. **Mischlich**

XXVI. Jahresb. Ver. Erdk. Dresden (1898): 33–98.

Verbot der nationalen Gebräuche in Krobo. Bericht des Herrn Missionars A Mischlich.

Some interesting particulars of the customs and beliefs of the Krobo people of the Gold Coast.

British West Africa—Gambia. *B.S.G. Lille* **30** (1898): 338–342. **Bonvalet.**

Notes sur la Gambie anglaise. Par E. Bonvalet.

These notes on the Gambia are the result of a personal visit.

British West Africa. *J. Anthrop. I.* **1** (1898): 95–103. **Shrubsall.**

Notes on Ashanti Skulls and Crania. By F. Shrubsall, B.A.

British West Africa—Niger. **Bindloss.**

In the Niger Country. By Harold Bindloss. London: W. Blackwood & Sons, 1898. Size 9 × 6, pp. x. and 338. *Maps. Price* 12*s.* 6*d. Presented by the Publishers.*

Mr. Bindloss gives a remarkably graphic account of the Niger Coast Protectorate, and of the other West African colonies excluding the Niger Company's domain. There is no attempt to exaggerate or to extenuate the conditions in which white men work upon the coast, and the various difficult questions which he considers are handled with calmness, discretion, and full knowledge.

British West Africa—Niger. *J. Anthrop. I.* **1** (1898): 104–126. **Granville and Roth.**

Notes on the Jekris, Sobos, and Ijos of the Warri District of the Niger Coast Protectorate. By Reginald K. Granville and Felix N. Roth. Prepared by H. Ling Roth. *With Plates.*

Cape Verd Islands. *B.S.G. Italiana* **12** (1899): 7–26. **Fea.**

Dalle Isole del Capo Verde. Lettera del . . . Leonardo Fea. *With Illustrations.*

Central Africa. **Bourdarie.**

Questions Dipl. et Colon. **5** (1898): 345–354, 419–427; **6** (1899): 21–30.

Les chemins de fer Congolais et de l'Afrique Centrale. Par M. Paul Bourdarie *With Maps.*

Central Africa—Angoniland. *Scottish G. Mag.* **15** (1899): 74–79. **Angus.**

A Trip to Northern Angoniland. By H. Crawford Angus.

Central Africa—Katanga. *Mouvement G.* **16** (1899): 121–124. ——

De Bruxelles au Katanga. *With Map.*

Congo. *Petermanns M.* **45** (1899): 19–21. **Singer.**

Das Kongo-Quellgebiet. Von H. Singer.

Congo State. *Mouvement G.* **16** (1899): 28–29. ——

La vingt et unième traversée de l'Afrique centrale.

The twenty-first crossing of Central Africa is that by Mr. Lloyd through the Pygmy country.

Congo State. **Boulger.**

The Congo State, or the Growth of Civilisation in Central Africa. By Demetrius C. Boulger. London: W. Thacker & Co., 1898. Size 9½ × 6, pp. viii. and 418. *Portrait, Map, and Illustrations. Price* 16*s.*

Congo State. *Fortnightly Rev.* **65** (1899): 433–444. **Boulger.**
The Congo State and its Critics. By Demetrius C. Boulger.

Congo State. *J.R. Statistical S.* **61** (1898): 640–667. **Courtney.**
An Experiment in Commercial Expansion. The Annual Address of the Right Hon. Leonard H. Courtney, M.A., M.P., President of the Royal Statistical Society. Session 1898–99.
A study of the economic condition of the Congo Free State.

Congo State. *Deutsche Rundschau G.* **21** (1899): 241–255. **Levy.**
Der Congostaat. Von Victor Levy. *With Illustrations.*

Congo State. *B.S. d'Études colon.* **5** (1898): 275–382. **Plas and Pourbaix.**
Le Régime économique et fiscal de l'État Indépendant du Congo. Par J. Plas et V. Pourbaix. (Deuxième partie.)

Congo State. *J. Anthrop. I.* **1** (1898): 35–47. **Burrows.**
On the Natives of the Upper Welle District of the Belgian Congo. By Captain Guy Burrows. *With Plate.*

Congo State. *B.S.R.G. d'Anvers* **22** (1898): 89–110. **Dubreucq.**
Les opérations Chaltin, dans le Haut-Uellé. Par le lieutenant R. Dubreucq.
On the military operations of the Congo State troops in the Wellé region.

Congo State. *Church Missionary Gleaner* (1899): 18–19. **Lloyd.**
Down the Congo from Uganda. By A. B. Lloyd. *With Map.*
Mr. Lloyd's interesting journey was referred to in the *Journal* for February, p. 195.

Congo State. **Wauters.**
A. J. Wauters. L'État Independant du Congo. Historique, Géographie physiqüe, Ethnographie, Situation économique, Organisation politique. Bruxelles: Falk, 1899. Size 7½ × 5, pp. xiv. and 528. *Map. Price 4s. 6d.*

Congo State. *Mouvement G.* **15** (1898): 586–589. **Wauters.**
Notre Carte de l'État Independant du Congo au 2,000,000e. Feuille X.: La région des sources du Congo, le Katanga et le bassin du Bangweolo. *With Map.*

Congo State. **Wildeman, Durand, Boulenger.**
État Indépendant du Congo. Annales du Musée du Congo publiées par ordre du Secrétaire d'Etat. Série I. Botanique Illustrations de la Flore du Congo, par Em. de Wildeman et Th. Durand. Tome i. (Fasc. 1 and 2), (pp. 48).—Série II. Zoologie, Matériaux pour la Faune du Congo. Poissons nouveaux, par G. A. Boulenger. Tome i. (Fasc. 1 and 2), (pp. 38). Bruxelles: Librairie Falk Fils, 1898. Size 15 × 11½. *Plates. Presented by M. le Secrétaire de l'État Indépendant du Congo.*

Egypt. **Alban.**
Trade of Egypt for the year 1897. Foreign Office, Annual No. 2197, 1898. Size 9½ × 6¼, pp. 24. *Price* 1½*d.*

Egypt. *P.R. Artillery I.* **26** (1899): 55–66. **Elmslie.**
Some Experiences in Egypt. By Major F. B. Elmslie, R.A. *With Illustrations.*
Description and photographs of the transport of troops up the Nile in the last Sudan expedition.

Egypt. *B.S. Khédiv. G.* **5** (1898): 123–128. **Fourtau.**
Note sur l'âge des forêts pétrifiées des déserts d'Égypte. Par M. R. Fourtau.

Egypt. ———
Egypt. No. 3 (1898). Further Correspondence respecting the Valley of the Upper Nile. London: Eyre & Spottiswoode, 1898. Size 13¾ × 8½, pp. 12. *Price* 2*d.*

Egypt—Early People. *Rev. Scientifique* **11** (1899): 289–296. **Zaborowski.**
Origines africaines de la civilisation de l'ancienne Égypte. Par M. Zaborowski.

Egyptian Sudan. *Scottish G. Mag.* **15** (1899): 57–74. ———
The Egyptian Sudan. *With Map.*

Egyptian Sudan. *P. R. Artillery I.* **26** (1899): 39–54. **Benson.**
A Patrol on the Atbara. By Major G. E. Benson. *With Map.*

Egyptian Sudan. **Gleichen.**
Handbook of the Sudan. Part I.—Geographical. The Sudan, South of Omdurman; from Wadai to Abyssinia, and from Khartum to the Albert Nyanza. Part II.—Historical Sketch of the History of the Sudan to date. Compiled in the Intelligence Division, War Office, by Captain Count Gleichen. 1898. London: Printed at the War Office, 1898. Size 7½ × 5, pp. xii. and 216. *Presented by the Compiler.*

A compact and systematic account of the eastern Sudan south of Khartum, with tables of distances along the Nile and its tributaries, and a summary of all existing information as to the resources of the country.

Egyptian Sudan. **Gleichen.**
Report on the Nile and Country between Dongola, Suakin, Kassala, and Omdurman. Describing the various routes bearing on this country. Compiled in the Intelligence Division, War Office, by Captain Count Gleichen. Second Edition. 1898. London: Printed at the War Office, 1898. Size 7½ × 5, pp. viii. and 338. *Maps. Presented by the Compiler.*

A description of the Nile between Dongola and Khartum, and of the Eastern desert, with routes and tables of distances.

Egyptian Sudan. *J. School G.* **3** (1899): 41–46. **Heawood.**
The Egyptian Sudan and its History. By Edward Heawood.

Egyptian Sudan. *Church Missionary Intelligencer* **50** (1899): 1–6. **Wilson.**
The Egyptian Soudan. By the Rev. C. T. Wilson. *With Map.*

Egyptian Sudan—Bahr-el-Ghazal. *Rev. Française* **24** (1899): 29–35. **Baratier.**
Dans les marais du Bahr-el-Ghazal. (Mission Marchand.) Lettre du capitaine Baratier.

French Congo. *B.S.G. Paris* **19** (1898): 308–327. **Foret.**
Le lac Fernan-Vaz (Congo français). Par M. Auguste Foret. *With Map.*

French Sudan. *A travers le Monde, Tour du Monde* **5** (1899): 5–6. **Combes.**
L'Aire géographique des Conquêtes de Samory. Par Paul Combes. *With Map.*

French West Africa. *B.S.G. Paris* **19** (1898): 328–374. **Pobéguin.**
Notes sur la Côte d'Ivoire. Région comprise depuis Grand-Lahou jusqu'au Cavally (République de Libéria). Par M. H. Pobéguin.

French West Africa. *Rev. Française* **24** (1899): 21–29. **Vasco.**
Poursuite et capture de Samory. Par G. Vasco. *With Map.*

German East Africa. *M. Deutsch. Schutzgeb.* **11** (1898): 251–253. **Adams.**
Vom Nyassa-See nach Upogoro und Donde. Von P. Alfons M. Adams. *With Map.*

The paper is followed by a note by Dr. Richard Kiepert on the map.

German East Africa. *Petermanns M.* **45** (1899): 1–4. **Langhans.**
Pater Dromaux' Durchquerung von Deutsch-Ostafrika (Bagamojo—Kiwele—Karema). Mit Benutzung brieflicher Mittheilungen des Reisenden. Von Paul Langhans. *With Map.*

German East Africa. *M. Deutsch. Schutzgeb.* **11** (1898): 253–283. **Prittwitz und Gaffron.**
Untersuchung der Schiffbarkeit des Kihansi und eines Theiles des Ulangaflusses. Von Hauptmann v. Prittwitz und Gaffron. *With Map.*

German East Africa. *M. Deutsch. Schutzgeb.* **11** (1898): 240–246. **Schnauder and Cohn.**
Astronomische Ortsbestimmungen von W. Bornhardt. Angestellt 1896 im Nyassa-Gebiete. Von M. Schnauder.
Astronomische Beobachtungen von Bergassessor W. Bornhardt (Mai bis Oktober 1897). Von Dr. Fritz Cohn.

German East Africa. **Wohltmann.**
Deutsch-Ostafrika. Bericht über die Ergebnisse seiner Reise ausgeführt im Auftrage der Kolonial-Abteilung des Auswärtigen Amtes, Winter 1897–98. Von Dr. F. Wohltmann. Schöneberg-Berlin: F. Telge, 1898. Size 9½ × 6½, pp. xii. and 92. *Map and Illustrations. Price* 4*s.* 6*d.*

German East Africa—Kilimanjaro. *Verh. Ges. Erdk. Berlin* **26** (1899): 88–101. **Meyer.**
Herr Dr. Hans Meyer: Ueber seine neue Kilima-Ndscharo-Expedition. *With Map.*

German East Africa—Kilimanjaro. *Die Natur.* **48** (1899): 27–29. **Reischel.**
Die Ergebnisse von Hans Meyer's Forschungsreise am Kilimandscharo. Von G. Reischel.

German East Africa—Uhehe. *M. Deutsch. Schutzgeb.* 11 (1898): 246–250. **Adams.**
Uhehe und das Land bis zum Nyassa-See. Von P. Alfons M. Adams. *With Map.*

German South-West Africa. *Globus* 75 (1899): 121–130. ——
Die wirtschaftliche Erschliessung Deutsch-Südwest-Afrikas. *With Illustrations.*
A notice of Dr. Rehbock's work on irrigation in German South-West Africa.

German West Africa—Kamerun. *Globus* 75 (1899): 1–4. **Hutter.**
Der Abschluss von Blutsfreundschaft und Verträgen bei den Negern des Graslandes in Nordkamerun. Von Hauptmann Hutter.
On blood-brotherhood as practised in the German protectorate.

German West Africa—Togo. *M. Deutsch Schutzgeb.* 11 (1898): 227–235. **Seefried.**
Beitrag zur Geologie des Schutzgebietes Togo. Von Lieutenant Frhrn. v. Seefried.
A description of rock-specimens collected in the north of Togo by Baron Seefried, and determined by Dr. v. Gümbel.

German West Africa—Togo. *M. Deutsch. Schutzgeb.* 11 (1898): 235–239. **Sprigade.**
Begleitworte zu der Karte des nördlichen Theiles des Schutzgebietes Togo und seiner Hinterländer. Von P. Sprigade. *With Map.*
These notes specify the sources of the information shown on the accompanying map, which is on the scale of 1 : 100,000, and takes in the area from 7° to 13° N., and from 1° 30′ W. to 3° 30′ E.

Gold Coast. *Tijds. Indische Taal-, Land- en Volkenk* 40 (1898): 385–496. **Doorman.**
Die Niederländisch West-Indische Compagnie an der Gold-Küste. Von J. G. Doorman. *With Map.*
This article describes the efforts of Usselinx early in the seventeenth century to promote Dutch colonization, and goes on to recount the proceedings of the Dutch West India Company, and the condition and history of the Gold Coast under Dutch control.

Gold Coast. *J.S. Arts* 47 (1899): 305–313. **Irvine.**
The Gold Mines of West Africa. By James Irvine.

Madagascar. *Antananarivo Annual* 6 (1898): 149–151. ——
The Fandroana or Annual Festival of the Taimoro; together with some other customs of that tribe.
The Taimoro tribe inhabit the south-eastern coast region of Madagascar. This description of the festival is translated from a native manuscript.

Madagascar. *Rev. Scientifique* 11 (1899): 261–269. **Gallieni.**
Mesures à prendre pour favoriser l'accroissement de la population en Emyrne. Par M. Gallieni.

Madagascar. *Antananarivo Annual* 6 (1898): 137–148. **Gautier.**
Western Madagascar: its Geology and Physical Geography. Translated from the French of Emile F. Gautier. By Rev. R. Baron.
Translated from the *Annales de Géographie* for April, 1895.

Madagascar. **Grandidier.**
Un Voyage de Découvertes sur les côtes Occidentale et Méridionale de l'Ile de Madagascar en 1613–1614. Relation par le P. Luiz Mariano, traduite et résumée par Alfred Grandidier. (Extrait du Bulletin du Comité de Madagascar.) Paris: A. Challamel, 1899. Size 10 × 6¾, pp. 30.

Madagascar. *Antananarivo Annual* 6 (1898). **Sibree.**
Industrial Progress in Madagascar. By Rev. J. Sibree.
Recounts the advances made in Madagascar in various industrial arts, mainly as a result of the efforts of British missionaries.

Madagascar. *Ann. G.* 8 (1899): 74–82. **Zimmermann.**
La forêt à Madagascar. Par M. Maurice Zimmermann. *With Map and Profiles.*
On the distribution of forests in Madagascar.

Mauritius. *J. R. Colonial I.* 30 (1899): 113–118. **Anderson.**
The Sugar Industry of Mauritius. By James Forrester Anderson.

South Africa. *J. R. Colonial I.* 30 (1899): 77–113. **Hillier.**
The Native Races of South Africa. By Alfred P. Hillier, B.A., M.D.

West Africa. **Kingsley.**
West African Studies. By Mary H. Kingsley. London: Macmillan & Co., 1899. Size 9½ × 6, pp. xxiv. and 640. *Map and Illustrations.* *Price* 21*s.*

West Africa. **Trilles.**
Miss. Catholiques **30** (1898): 6, 18, 31, 41, 51, 68, 81, 92, 104, 116, 128, 136, 153, 166, 188, 199, 212, 226, 236, 261, 268, 285, 296, 310, 322, 329, 427, 435, 449, 464, 472, 490, 499, 508, 521, 534, 550.
Chez les Fang. Par le R. P. Trilles. *With Map and Illustrations.*

NORTH AMERICA.

Alaska. **Dunham.**
The Alaskan Goldfields and the opportunities they offer for Capital and Labor. By Sam. C. Dunham. (Bulletin of the Department of Labor. No. 19, November, 1898.) Washington, 1898. Size 9 × 6, pp. 789–828.

Bering Sea and Alaska. **Maclear.**
Sailing Directions for Bering Sea and Alaska, including the North-East Coast of Siberia. Compiled from various sources by Vice-Admiral J. P. Maclear. London: J. D. Potter, 1898. Size 9½ × 6, pp. xxvi. and 344. *Index Charts.* *Price* 4*s.* *Presented by the Hydrographer of the Admiralty.*

Canada. *Globus* **75** (1899): 85–89. **Bach.**
Der canadische Winter. Von Rudolph Bach. *With Illustrations.*

Canada. *J. R. Colonial I.* **30** (1899): 186–204. **Shaw.**
Klondike. By Miss Flora L. Shaw.

Canada. **Wrong and Langton.**
University of Toronto Studies. History, First Series, vols. 2 and 3. Review of Historical Publications relating to Canada for the year 1897. Edited by Prof. George M. Wrong, assisted by H. H. Langton (pp. x. and 238). Ditto for the year 1898. Edited by Prof. George M. Wrong and H. H. Langton (pp. x. and 226). [Toronto]: The University Library, 1898–99. Size 10½ × 7½. *Presented by the University of Toronto.*

A catalogue of current works on Canada, each title being followed by a short critical notice.

Canada—Geological Survey. ——
Geological Survey of Canada. Annual Report (New Series), Vol. IX. Reports A, F, I, L, M, R, S. 1896. Ottawa, 1898. Size 10 × 6½. *Maps and Illustrations.* *Presented by the Survey.*

This volume contains a summary report of the year's work by the Director; a report of over 200 pages by Mr. J. B. Tyrrell on the Doobaunt, Kazan, and Ferguson rivers, and the north-west coast of Hudson bay; a report by Dr. R. Bell on the geology of the French River sheet, Ontario; on the northern part of the peninsula of Labrador, by Mr. H. Low; on the geology of south-west Nova Scotia, by Mr. L. W. Bailey; and various mineralogical and statistical reports.

Canada—New Brunswick. ——
Saint John as a Canadian Winter Port, issued under the auspices of the City Corporation and Board of Trade. Saint John, New Brunswick, 1898. Size 10 × 7, pp. 22. *Map, Plans, and Illustrations.* *Presented by the Natural History Society of New Brunswick.*

Canada—Rocky Mountains. *Blackwood's Mag.* **165** (1899): 540–557. **Stutfield.**
Mountain exploration in the Canadian Rockies. By Hugh E. M. Stutfield.

On the search for Mount Hooker and Mount Brown, recently described by Prof. Collie to the Society.

Canada—Stikine River. *National G. Mag.* **10** (1899): 1–15. **Scidmore.**
The Stikine River in 1898. By Eliza Ruhamah Scidmore. *With Illustrations.*

Mexico—Vera Cruz. *B.S.G. y Estad. Rep. Mexicana* **4** (1898): 31–49. **Zárate.**
El Estado de Veracruz. Ensayo Geográfico y Estadistico del Sr. Lic. D. Julio Zárate.

Newfoundland. *A travers le Monde, Tour du Monde* **5** (1899): 37–38. ——
Les Droits de la France à Terre-Neuve. Le "French Shore." *With Map.*

Newfoundland. *Questions Dipl. et Colon.* **6** (1899): 140–152, 205–219. **Garreau.**
Les Intérêts français à Terre-Neuve. Par G. Garreau. *With Map.*

Niagara. **Martin.**

The Utilization of Niagara. By Thomas Commerford Martin.—Annual Report of the Smithsonian Institution, 1896, pp. 223–232. *Plates.* Washington, 1898.

Reprinted from the *Proceedings* of the Royal Institution.

United States. **Baedeker.**

The United States, with an Excursion into Mexico. Handbook for Travellers, edited by Karl Baedeker. *With* 19 *Maps and* 24 *Plans.* Second Revised Edition. Leipsic: K. Baedeker; London: Dulau & Co., 1899. Size 6½ × 4½, pp. c. and 580. *Price* 12*s.* *Presented by Messrs. Dulau & Co.*

United States. *J. School G.* **3** (1899): 1-5, 46–54. **Fenneman.**

Climate of the Great Plains. By N. M. Fenneman.

United States. **Inman and Cody.**

The Great Salt Lake Trail. By Colonel Henry Inman and Colonel William F. Cody. New York: the Macmillan Co.; London: Macmillan & Co., 1898. Size 9 × 6, pp. xii. and 530. *Map and Illustrations. Price* 14*s. net. Presented by the Publishers.*

This is a striking history of inland exploration and adventure, dealing as it does with the road across the Rocky mountains, past Salt Lake City, traversed by the Mormons, and later by the pony express and the overland stage before these were superseded by the telegraph and the railway. Colonel Cody ("Buffalo Bill") speaks from personal experience of the early days of the fight with an unusually adverse environment of desert, mountain, and hostile natives, and a considerable part of the volume deals with his adventures. The book appropriately concludes with the driving of the last spike of the first transcontinental railway.

United States. *Deutsche G. Blätter* **21** (1898): 175–312. **Oppel.**

Wirtschaftsgeographische Reise durch die Vereinigten Staaten. Von Dr. A. Oppel.

United States. **Rossi.**

Stati Uniti. L'Emigrazione Italiana agli Stati Uniti nell'anno 1897-98. Rapporto del cav. Egisto Rossi.—Bollettino del Ministero degli Affari Esteri. Dicembre, 1898. Roma, 1898. Size 9½ × 6½, pp. 30.

United States. *P.I. Civil Engineers* **134** (1898): 334–351. **Bartlett.**

The Transport of Coal on the Ohio and the Lower Mississippi. By J. H. Bartlett.

United States—Boundary. **Mendenhall.**

Twenty unsettled Miles in the North-east Boundary. By T. C. Mendenhall. Worcester, Mass., 1897. Size 10 × 6, pp. 26. *Map. Presented by the Author.*

On a part of the boundary between the United States and Canada in the north-east.

United States—California. *B.S.G. y Estad. Rep. Mexicana* **4** (1898): 131-145. **Jacobs.**

La Region Aurifera de la Alta California. Estudio presentado por el Sr. Henry S. Jacobs y traducido por el Sr. Ingeniero Enrique A. Turnbull.

Historical notes on the Californian goldfields.

United States—California. *Deutsche Rundschau G.* **21** (1898): 115–123. **Rabe.**

Das Erdbeben von Owens Valley in Californien. Von Johannes Karl Rabe. *With Illustrations.*

Recollections of the effects of the great earthquake of March 26, 1872.

United States—California. **Ransome.**

Some Lava Flows of the Western Slope of the Sierra Nevada, California. By F. Leslie Ransome.—Bulletin of the United States Geological Survey, No. 89. Washington, 1898. Size 9½ × 6, pp. 74. *Maps and Illustrations. Presented by the U.S. Geological Survey.*

United States—Clouds. *National G. Mag.* **9** (1898): 493–496. **Johnson.**

Cloud Scenery of the High Plains. By Willard D. Johnson. *With Illustrations.*

A striking series of photographs showing the marvellous variety imparted to the absolutely monotonous scenery of the great American plains by the variety of cloud effects.

United States—Indian Territory. *National G. Mag.* **9** (1898): 481–490. **Fitch.**

The Five Civilized Tribes and the Survey of Indian Territory. By C. H. Fitch. *With Map and Illustrations.*

United States—Pennsylvania. *J. Franklin I.* **146** (1898): 416–423. **Lyman.**
Copper traces in Bucks and Montgomery Counties. By Benj. Smith Lyman. *With Map.*

United States—Tides. *National G. Mag.* **9** (1898): 497–509. **Jefferson.**
Atlantic Coast Tides. By Mark S. W. Jefferson. *With Diagrams.*
On the tides on the coast of New York and the New England States.

CENTRAL AND SOUTH AMERICA.

Argentina—Patagonia. *Deutsche Rundschau G.* **21** (1899): 206–219. **Greger.**
Patagonien und dessen Bewohner. Von J. Greger. *With Illustrations.*

Argentina—Patagonia. *Globus* **75** (1899): 101–104. **Hauthal.**
Erforschung der Glacialerscheinungen Südpatagoniens. Von Dr. R. Hauthal.

Argentine-Chile Boundary. **Steffen.**
Zur Erforschung des chilenisch-argentinischen Grenzgebiets in Patagonien. Von Dr. H. Steffen. (Abdruck aus Dr. A. Petermanns Mitteilungen, 1898, Heft 6.) Size 11 × 9½.

Argentine Republic. ———
Segundo Censo de la República Argentina Mayo 10 de 1895. Tomo ii. Población. Buenos Aires, 1898. Size 14 × 10½, pp. cxciv. and 710. *Maps and Diagrams. Presented by the Argentine Census Commission.*
This volume is devoted to the statistical, diagrammatic, and cartographic representation of the population of the Argentine Republic according to provinces and composition. The treatment of the statistics bearing on the foreign population of the country is particularly clear and graphic.

Bolivia. *B.S.G. La Paz* **1** (1898): 120–137, 137–161. **Marbán.**
Relación de la Provincia de la Virgen del Pilar de Mojos. Por el Padre Marbán, de la Compañia de Jesús.

Bolivia. *B.S.G. La Paz* **1** (1898): 92–119, 1–54. **Paredes.**
Monografía de la Provincia de Muñecas. Por M. Rigoberto Paredes.

Bolivia—Earthquakes. *B.S.G. La Paz* **1** (1898): 138–141, 162–167. **Saavedra.**
Caracteres seismicos de los Andes y del territorio boliviano. Por B. Saavedra.

Brazil. **Beaumont.**
Trade, Finances, and Colonisation of the Three Southern States of Brazil. Foreign Office, Miscellaneous, No. 493, 1899. Size 10 × 6, pp. 24. *Map. Price* 4½*d.*

Brazil—Minas Geraes. **Beaumont.**
A Journey to the Diamond Fields of Minas Geraes, and Remarks on the Province of Minas Geraes. Foreign Office, Miscellaneous, No. 494, 1899. Size 10 × 6½, pp. 30. *Price* 2*d.*

Central America. **Sapper.**
Ueber Gebirgsbau und Boden des nördlichen Mittelamerika. Von Dr. Carl Sapper.—Dr. A. Petermanns Mitteilungen, Ergänzungsheft Nr. 127. Gotha: Justus Perthes, 1899. Size 11 × 8, pp. vi. and 120. *Maps and Profiles.*
This piece of detailed work, by the indefatigable Dr. Carl Sapper, is accompanied by large maps of Northern Central America, as far east as the Gulf of Fonseca, on the scale of 1 : 1,100,000; one showing orographical features by tinted contours, the other geological. There are also a soil-map and a number of geological sections.

Tierra del Fuego. **Nordenskjöld.**
Från Eldslandet. Skildringar från den Svenska Expeditionen till Magellansländerna, 1895–97, samlade af Otto Nordenskjöld. Stockholm: P. A. Norstedt & Söner [not dated]. Size 10½ × 7, pp. 254. *Map and Illustrations.*
The narrative of Dr. Otto Nordenskjöld's exploration in the extreme south of South America. The map, which is orographically coloured, has its title and explanations in English.

West Indies—Mona. *Globus* **74** (1898): 368–372. **Hübener.**
Die Inseln Mona und Monito. Von Dr. Th. Hübener. *With Map and Illustrations.*
Description of the guano-yielding island of Mona, attached to Porto Rico.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia. **Thomson.**

The Physical Geography of Australia. By J. P. Thomson.—Annual Report of the Smithsonian Institution, 1896. Pp. 245–272. Washington, 1898.

Reprinted from the *Proceedings* of the Brisbane branch of the Australasian Geographical Society.

Australia—Oceanography. **Fowler.**

Australasian Association for the Advancement of Science. Sydney Session, 1898. A Contribution to Australian Oceanography. By Thomas Walker Fowler. [Sydney, 1899.] Size 8½ × 5½, pp. 16. *Presented by the Author.*

British New Guinea. **Bevan.**

The Gold Rush to British New Guinea, 1887, and the Discovery of Aird and Purari Rivers. Also Supplement. By Theodore F. Bevan. (Extract from Transactions of the Royal Geographical Society of Australasia (Victoria), vol. xv.) Melbourne, 1898. Size 10 × 6½, pp. 8. *Map.*

British New Guinea. **Nelson.**

Report by the Right Honourable Sir H. M. Nelson on his Visit to British New Guinea. Brisbane, 1898. Size 13½ × 8½, pp. 32. *Presented by Dowager Lady Lamington.*

British New Guinea. **MacGregor.**

Annual Report on British New Guinea, from July 1, 1897, to June 30, 1898; with Appendices. Brisbane, 1898. Size 13½ × 8½, pp. xlvi. and 150. *Maps and Plates.*

A note on this report appears in the *Journal*, p. 540.

Ellice Islands—Funafuti. **David.**

Funafuti, or Three Months on a Coral Island: an Unscientific Account of a Scientific Expedition. By Mrs. Edgeworth David. London: John Murray, 1899. Size 8½ × 6, pp. xiv. and 318. *Portraits, Map, and Illustrations. Price* 12*s. Presented by the Publisher.*

A record of Prof. David's stay on Funafuti during the successful boring operations carried out with the purpose of testing the depth to which coral formations extend.

Hawaii. *J. Franklin I.* **147** (1899): 31–52. **Wiley.**

Agriculture in the Hawaiian Islands. By Dr. Harvey W. Wiley.

POLAR REGIONS.

Antarctic. *Verh. Ges. Erdk. Berlin* **26** (1899): 58–87.

Gemeinschaftliche Sitzung der Gesellschaft für Erdkunde zu Berlin und der Abteilung Berlin-Charlottenburg der Deutschen Kolonial-Gesellschaft am 16 Januar 1899. Tagesordnung: Die geplante Deutsche Südpolar-Expedition. Vortrag von Dr. v. Drygalski. Bemerkungen von Geh. Reg.-Rat v. Bezold. *With Map.*

The results of the meeting here described, were given in the *Journal* for April, p. 406.

Arctic Explorations. **Markham.**

Arctic Explorations. By Rear-Admiral A. H. Markham.—Annual Report of the Smithsonian Institution, 1896. Pp. 273–296. Washington, 1898.

Reprinted from the 'Report of the Sixth International Geographical Congress.'

MATHEMATICAL GEOGRAPHY.

Barometric altitudes. **Fowler.**

Australasian Association for the Advancement of Science. Sydney Session, 1898. The Determination of Heights by Barometric Methods, by Thomas Walker Fowler. [Sydney, 1899.] Size 8½ × 5½, pp. 8. *Presented by the Author.*

Describes experiments as to the determination of heights with the aneroid and boiling-point thermometer.

Geodesy. *B. Philosoph. S. Washington* **13** (1899): 251–268. **Preston.**

Recent Progress in Geodesy. By Erasmus Darwin Preston. *With Maps.*

Treats of the present position of our knowledge as to the size and figure of the Earth, and touches on the tetrahedral theory.

Hydrographical Surveying. **Wharton.**

Hydrographical Surveying. A description of the means and methods employed in constructing Marine Charts. By Rear-Admiral Sir William J. L. Wharton, K.C.B. Second and Revised Edition. London: John Murray, 1898. Size 9½ × 6, pp. viii. and 388. *Illustrations.* *Price* 18*s.* *Presented by the Publisher.*

The author states in his preface to the new edition of this well-known work that he has endeavoured to alter it as little as possible, confining the changes to necessary corrections and the description of new methods and instruments which have come into use since the first edition was prepared seventeen years ago. The most important modifications are in the methods of deep-sea soundings, on account of the revolution in the exclusive use of wire instead of hemp sounding-lines.

Latitude determination. *B.S.G. La Paz* **1** (1898): 125–136. **Idiaquez.**

Latitud Geográfica. Procedimiento preciso para su determinación. Por Eduardo Idiaquez.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Atmospheric Phenomena. **Cornu.**

Physical Phenomena of the Upper Regions of the Atmosphere. By Prof. Alfred Cornu.—Annual Report of the Smithsonian Institution, 1896. Pp. 125–133. *Plate.* Washington, 1898.

Translated from the original French memoir in the *Proceedings* of the Royal Institution.

Aurora. *Terrestrial Magnetism* **3** (1898): 5–12, 53–76, 149–178. **Abbe.**

The Altitude of the Aurora above the Earth's Surface. By Prof. Cleveland Abbe.

Climatology. **Manson.**

The Laws of Climatic Evolution. [By Marsden Manson, C.E., PH.D.] U.S. Department of Agriculture, Report for December, 1898. California Section of the Climate and Crop Service of the Weather Bureau. Size 12 × 9½, pp. 4–8.

Geological Deposits. **Van't Hoff, Williams, Meyerhoffer.**

Sitzb. A.W. Berlin (1898): 808–822.

Untersuchungen über die Bildungsverhältnisse der oceanischen Salzablagerungen, insbesondere des Stassfurter Salzlagers. X. Von J. H. van't Hoff und Percy Williams. XI. Von J. H. van't Hoff und Dr. W. Meyerhoffer.

Geomorphology. **Le Conte.**

Earth-Crust Movements and their Causes. By Joseph Le Conte.—Annual Report of the Smithsonian Institution, 1896. Pp. 233–244. Washington, 1898.

Reprint from *Science.*

Limnology. *Rev. Scientifique* **11** (1899): 140–142. **Forel.**

Les flaques d'eau libre dans la glace des lacs gelés. Par M. F.-A. Forel.

Limnology. *Die Natur* **47** (1898): 595–596, 604–606. **Ule.**

Zur Physik der Binnenseen. Von Willi Ule. III. Die Temperaturverhältnisse.

Marine Biology. **Murray.**

The General Conditions of Existence and Distribution of Marine Organisms. By Dr. John Murray.—Annual Report of the Smithsonian Institution, 1896. Pp. 397–409. Washington, 1898.

Reprinted from the 'Report of the Third International Congress of Zoologists.'

Meteorology. **Inwards.**

Meteorological Observations. By Richard Inwards.—Annual Report of the Smithsonian Institution, 1896. Pp. 149–166. Washington, 1898.

Reprinted from the *Journal* of the Royal Meteorological Society.

Meteorology. *Nineteenth Century* **45** (1899): 415–423. **Kropotkin.**

Weather Prediction. By Prince Kropotkin.

Oceanography. *P. Canadian I.* **1** (1898): 134–135. **Denison.**

The Origin of Ocean Tidal Secondary Undulations. By F. Napier Denison.

Oceanography. **Cronander.**

On the Laws of Movement of Sea-Currents and Rivers. By A. W. Cronander, PH.D. Norrköping, 1898. Size 12 × 10, pp. 58, 18, 22, 28, 6, 6, and 18. *Diagrams.* *Presented by the Author.*

Oceanography. *C. Rd.* **128** (1899): 212–214. **Monaco.**

Première compagne de la *Princesse-Alice* II^e^. Note de S. A. S. le Prince Albert I^er^ de Monaco.

Notes on the cruise of the new *Princesse Alice*, a steamer of 1400 tons, to Spitsbergen in 1898.

Oceanography. *Nineteenth Century* **45** (1899): 295–303. **Pettersson.**

International Fishery Legislation. By Prof. Otto Pettersson.

Oceanography—Currents. *Ann. Hydrographie* **26** (1898): 519–521. ——

Unterströmungen in der Strasse von Bab-el-Mandeb.

A summary, with notes, of Commander Gedge's report on the work done by H.M.S. *Stork* in the strait of Bab el Mandeb.

Oceanography—North Atlantic. ——

Observations météorologiques-nautiques 1897 publiées par l'Institut Météorologique de Danemark. Kjøbenhavn, 1898. Size 12½ × 9½, pp. xviii. and 206. *Diagrams.*

The text is in parallel columns, French and Danish; the observations deal with ice-conditions in the East Greenland sea, air-temperatures at different hours at the Danish lightships, and on the temperature of the surface water in the North Atlantic and Davis strait in 1897.

Oceanography—Pacific. *Petermanns M.* **45** (1899): 4–8. **Lindenkohl.**

Physiographische Probleme, Salzgehalt und Temperatur des Pacifischen Ozeans betreffend. Von A. Lindenkohl. *With Diagrams.*

Oceanography—South Atlantic. *Ann. Hydrographie* **27** (1899): 37–39. **Dinklage.**

Unerforschte Bank im Südatlantischen Ozean. Von L. E. Dinklage.

This note calls attention to the fact that in 1854 a vessel bound from Callao to Mauritius found shallow soundings (80 to less than 25 fathoms) along a stretch of ocean midway between Cape Horn and the Cape of Good Hope. Other vessels also at various dates have reported signs of shallow water, but the facts are not recorded on the charts, and have been almost forgotten.

Photogeography. *Naturw. Wochenschrift* **13** (1898): 601–608. **Detmer.**

Zur Charakteristik einiger Vegetationsformationen. Von Prof. Dr. W. Detmer.

On the general characteristics of vegetation in the different classes of woodland.

Seismology. *Atti R.A. Lincei, Rendiconti* **8** (1899): 41–46. **Agamennone.**

Sopra un nuovo tipo di sismoscopio. Nata di G. Agamennone. *With Illustration.*

Seismology. *Atti R.A. Lincei, Rendiconti* **8** (1899): 46–48. **Cancani.**

Nuovo sismometrografo a registrazione veloce-continua. Nota del dott. Adolfo Cancani.

Seismology. *Atti R.A. Lincei, Rendiconti* **8** (1899): 76–79. **Cancani**

Periodicità dei terremoti adriatico-marchigiani e loro velocità di propagazione a piccole distanze. Nota del dott. Adolfo Cancani.

Terrestrial Magnetism. *Meteorolog. Z.* **15** (1898): 449–462. **Schwalbe.**

Mittheilungen über die jährliche Periode der erdmagnetischen Kraft. Von G. Schwalbe.

Zoogeography. *Blackwood's Mag.* **165** (1899): 89–92. **Sharpe.**

The Preservation of African Elephants. By Alfred Sharpe.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropology. **Ratzel.**

The History of Mankind. By Prof. Friedrich Ratzel. Translated from the Second German Edition. By A. J. Butler, M.A. With Introduction by E. B. Tylor, D.C.L., F.R.S. 3 vols. London: Macmillan & Co., 1896–98. Size 10 × 7, pp. (vol. i.) xxiv. and 486; (vol. ii.) xiv. and 562; (vol. iii.) xiv. and 600. *Maps, Coloured Plates, and Illustrations. Presented by the Publishers.*

This work has been published in parts, and is now completed in three handsomely illustrated volumes. It is gratifying to find so important a scientific work well translated, and put before the British public in a form so attractive that it will interest even the unscientific.

Commercial Geography—Cables. *Rev. Française* **24** (1899): 215–220. **Salaignac.**

Les communications télégraphiques sous-marines, au point de vue stratégique. Par A. Salaignac. *With Map.*

Commercial Geography—Canals. *J.S. Arts* **47** (1899): 153–172. **Vernon-Harcourt.**

Inland Navigation in Europe and North America, with special reference to Inland Navigation in England. By Leveson Francis Vernon-Harcourt.

Historical. *B.S.G. Paris* **19** (1898): 375–387. **Corbeiller.**

La question Jean Cousin. Par Édouard le Corbeiller.

A discussion of the claims of the Dieppe navigator, Jean Cousin, to have discovered the mouth of the Amazon and the southern point of Africa in 1489.

Historical—Fernando Columbus. **Castillo y Quartiellerz.**

B.S.G. Madrid **40** (1898): 193–201.

Documento inédito del siglo xvi. referente á D. Fernando Colón. Conferencia dada el dia 24 de Mayo de 1898 por el Excmo. Sr. D. Rodolfo del Castillo y Quartiellerz.

Historical—Maps. **Magnaghi.**

La Carta Nautica Costruita nel 1325 da Angelino Dalorto. Notizia di Alberto Magnaghi. (Ai cultori degli studi geografici per ricordo del Terzo Congresso Geografico Italiano e delle secolari onoranze a Paolo Toscanelli e ad Amerigo Vespucci offre Tommaso Corsini.) Firenze, 1898. Size 14 × 10, pp. 16. *Map. Presented by Principe Tommaso Corsini.*

Historical—The Levant. ———

LXII. Neujahrsblatt zum Besten des Waisenhauses in Zürich für 1899. Ein Jerusalem- und Sinaipilger aus Zürich im 15 Jahrhundert: der Predigermönch Felix Schmid. Zürich, 1899. Size 11 × 9, pp. 62. *Illustrations. Presented by the Secretary of the Stadtbibliothek, Zürich.*

An account of the journeys of the monk Felix Schmid to Jerusalem in 1480 and subsequent years.

Historical—Vasco da Gama. ———

Quatrième Centenaire de Vasco da Gama à la Société de Géographie de Lisbonne. Extrait du 'Bulletin de la Société royale belge de Géographie,' 1898. Bruxelles, 1898. Size 9 × 6½, pp. 8.

BIOGRAPHY.

Campbell. **Bryce.**

Sketch of the Life and Discoveries of Robert Campbell, Chief Factor of the Hon. Hudson's Bay Company. By George Bryce, LL.D. The Historical and Scientific Society of Manitoba. Transaction No. 52. Winnipeg, 1898. Size 9 × 6, pp. 18. *Portrait and Illustrations. Presented by the Society.*

Robert Campbell (1808–1894) was the discoverer of the Upper Yukon, and gave the names of most of the rivers and mountains in that region which now appear on the map.

Giraud. *Deutsche Rundschau G.* **21** (1899): 231–232. ———

Victor Giraud. *With Portrait.*

Honterus. *Deutsche Rundschau G.* **21** (1899): 228–230. ———

Johannes Honterus. *With Illustration.*

Prestwich. **Woodward.**

Joseph Prestwich. By H. B. Woodward. Annual Report of the Smithsonian Institution, 1896. Pp. 657–666. Washington, 1898.

Reprinted from *Natural Science.*

Proskowetz. *Deutsche Rundschau G.* **21** (1899): 278–280. ———

Dr. Max v. Proskowetz. *With Portrait.*

Ross. *Deutsche Rundschau G.* **21** (1899): 276–278. ———

Sir James Clark Ross. *With Portrait.*

Selwyn. *Geolog. Mag.* **6** (1899): 49–55. ———

Eminent Living Geologists: Alfred Richard Cecil Selwyn, C.M.G., etc. *With Portrait.*

GENERAL.

Abyssinian Literature. **Budge.**

Lady Meux Manuscript No. 1. The Lives of Mabâ' Sĕyôn and Gabra Krĕstôs. The Ethiopic Texts edited with an English Translation and a Chapter on the Illustrations of Ethiopic Manuscripts. By E. A. Wallis Budge, M.A., etc. With Ninety-two Coloured Plates and Thirty-three Illustrations. London: W. Griggs, 1898. Size 12½ × 10½, pp. lxxxiv., 144, and 66. *Presented by Lady Meux.*

This superb volume contains a series of brilliant reproductions of Ethiopian pictures of the early part of the seventeenth century, together with the English translation and Ethiopian text of the lives of the saints whose doings are represented.

Amber in Early Trade. **Schweiger-Lerchenfeld.**

Oesterr. Monats. Orient **24** (1898): 138–142.

Der Bernstein als Handelsartikel der Alten. Von A. v. Schweiger-Lerchenfeld.

Army Medical Report. ———

Army Medical Department. Report for the year 1897. With Appendix. Volume xxxix. London: Eyre and Spottiswoode, 1898. Size 9½ × 6½, pp. x. and 602. *Diagrams. Price* 2*s.* 11*d. Presented by the War Office.*

Ballooning. *J.S. Arts* **47** (1899): 277–284. **Bacon.**

The Balloon as an Instrument of Scientific Research. By Rev. John M. Bacon. *With Diagrams.*

Ballooning. *Rev. Scientifique* **11** (1899): 138–140. **Hervé.**

Les ballons à déviateurs. Par M. Henri Hervé. *With Map.*

Bibliography—English Catalogue. ———

The English Catalogue of Books for 1898. London: Low & Co., 1899. Size 10 × 6½, pp. 256. *Price* 5*s.*

British Empire. **Sanderson.**

The British Empire in the Nineteenth Century: its Progress and Expansion at Home and Abroad, comprising a description and history of the British Colonies and Dependencies. By Edgar Sanderson, M.A. 6 vols. London, etc.: Blackie & Son, 1898. Size 10½ × 7, pp. (vol. i.) viii. and 336; (vol. ii.) viii. and 344; (vol. iii.) viii. and 344; (vol. iv.) viii. and 344; (vol. v.) viii. and 362; (vol. vi.) viii. and 370. *Maps and Illustrations. Presented by the Publishers.*

"The purpose of this work is to depict the progress and condition of the British Empire in the nineteenth century, and to furnish a complete historical and descriptive account of our Colonial Possessions and Dependencies in every quarter of the globe, from the time of British occupation, or, in some cases, from an earlier period, till the present day." Besides the general histories, chapters are devoted to the progress in various branches of science, art, literature, and public life during the century; amongst others, exploration and travel receive brief notice, but the development of scientific geography is not referred to. So rapidly does the Empire progress, that the maps in this work are in some cases already out of date, *e.g.* in the Niger boundaries, and the great mining centres and railways of Canada. An interesting set of pictorial statistics, comparing 1801 and 1897, concludes the book.

Coins. **Macdonald.**

Catalogue of Greek Coins in the Hunterian Collection, University of Glasgow. Volume I. Italy, Sicily, Macedon, Thrace, and Thessaly. By George Macdonald, M.A. Glasgow: James Maclehose & Sons, 1899. Size 12 × 9½, pp. lxvi. and 496. *Plates. Presented by the Hunterian Museum.*

Oriental Literature. **Das.**

Legends and Miracles of Buddha, Sakya Sinha. Part i. Translated from the Avadan Kalpalata of Bodhi-Sattwas, of the great Sanskrit Poet Kshemendra. By Nobin Chandra Das, M.A. Calcutta: Jadu Nath Seal, 1895. Size 8½ × 5½, pp. xvi. and 60. *Presented by the Author.*

Travel round the World. **[Chaudoir.]**

Ballade autour du Monde, par un Ancien de la Cambre. Bruxelles: Société Belge de Librairie, 1899. Size 10 × 6½, pp. 300. *Maps and Illustrations. Presented by the Publishers.*

The author of this prettily illustrated record of a somewhat unusual trip round the world is stated in an accompanying circular to be M. Puck Chaudoir. The selection and reproduction of the illustrations are particularly good. The route led through

Egypt, Ceylon, Tuticorin, Madras, Poona, Delhi, Calcutta, Manipur, through the Shan country to Mandalay, from Moulmein to Bangkok overland, thence by sea touching at Singapore, Saigon, Hongkong, Japan, and back to Europe through Canada.

Treaties.

Miscellaneous, No. 2 (1898). Treaties containing Guarantees or Engagements by Great Britain in regard to the Territory or Government of other Countries. London: Eyre & Spottiswoode, 1898. Size 13¼ × 8½, pp. vi. and 136. *Price* 1*s.* 2*d.*

NEW MAPS.

By J. COLES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**

Publications issued since March 8, 1899.

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Germany. **Gradmann.**

Der obergermanisch-rätische Limes und das fränkische Nadelholzgebiet von Dr. R. Gradmann. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1899, Tafel 6. Gotha : Justus Perthes, 1899. *Presented by the Publisher.*

Germany. **Langhans.**

Deutsche und Dänen in Nordschleswig. Scale 1 : 500,000 or 7·9 stat. miles to an inch. Paul Langhans. *Petermanns Geographische Mitteilungen*, Jahrgang 1899, Tafel 4. Gotha : Justus Perthes, 1899. *Presented by the Publisher.*

Germany. **Königl. Preuss. Landes-Aufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartogr. Abtheilung der Königl. Preuss. Landes-Aufnahme, 1898. Sheets: 297, Zielenzig; 321, Krossen a.d. Oder; 330, Münster; 405, Lüdenscheid; 406, Attendorn; 431, Waldbröl. Scale 1 : 100,000 or 1·6 stat. mile to an inch. *Price* 1.50 *marks each sheet.*

ASIA.

Central Asia. **Grenard.**

J.-L. Dutreuil de Rhins. Mission Scientifique dans la Haute Asie. Atlas des Cartes par F. Grenard. Ouvrage publiè sous les auspices du Ministère de l'Instruction Publique et des Beaux-Arts. Paris: Ernest Leroux, 1898. *Presented by the Author.*

This atlas contains twenty-five maps, giving the results of the route-surveys of MM. J. L. Dutreuil de Rhins and F. Grenard, made during their journeys through Central Asia from Khotan to Sining. The maps have been produced under the auspices of the Ministry of Public Instruction, Paris, and drawn by M. J. Hansen, under the direction of Mr. F. Grenard. Those of Eastern Turkistan are on the scale of 1 : 300,000; those of the journey through Tibet, on the scale of 1 : 500,000. Positions have been fixed by the astronomical observations of M. Dutreuil de Rhins, altitudes are given along the routes followed, notes describing the character of the country traversed are given, and the hill work shown by contours. A glance at this series of maps will show the large amount of careful survey work which these explorers accomplished under very difficult circumstances.

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, 4 miles to an inch. Sheets: 111, parts of districts Muzaffarpur, Darbhanga, Bhagalpur, and Purnea (Bengal), and of Nepal; 118, district Jalpáiguri and Kuch Behar (Native State), and parts of districts Darjiling, Goálpára, Rangpur, Sikkim, and Bhutan (Native States). Quarter-sheets: 1, parts of districts Karachi, Shikarpur, and Hyderabad, and Native State of Khairpur (Sind, Bombay Presidency); 9 N.W., parts of districts Shikarpur and Hyderabad, and of Khairpur Native State (Sind, Bombay Presidency); 37 S.W., parts of districts Surat, Khándesh, and Nasik, Rewa Khantha, Surat and Khandesh Agencies, and Native State of Baroda (Bombay Presidency); 61 N.E., parts of districts Salem, Coimbatoire, and Nilgiri (Madras Presidency), and of the Native State Mysore; 67 S.W., parts of districts Bareilli, Budaun, Aligarh, etc., and of Rámpur Native State (N.W. Provinces); 95 N.W., part of district Kistna (Madras Presidency); 124 N.E., part of districts Nowgong and Darrang of Assam and Bhutan; 124 S.E., parts of districts Kamrup, Nowgong, Darrang, Cachar, Khasi, and Jaintia and Naga Hills (Assam); 127 N.W., parts of districts Backergunge and Noakhali (Bengal).—Skeleton map of the Punjab and surrounding countries, 1 inch to 32 miles. Additions to September, 1898.—Sind Survey, 1 inch to a mile. No. 66, districts Hyderabad and Thar and Porkar, Season 1896–97, Preliminary Issue.—Central India and Rajputana Survey, 1 inch to a mile. No. 213, parts of Gwalior, Jhabua, Bori, Rajpur Ali, Jobat, and Indore (Central India Agency), Season 1879–80.—Bengal Survey, 1 inch to a mile. Parts of districts Lohardaga and Singhbhum (Bengal), Season 1863–65.—Lower Burma Survey, 1 inch to a mile. No. 282, district Hanthawadi, Season 1881–82.—District Mymensingh, Bengal, 1 inch to 8 miles. Corrections to 1898.—District Raipur, Central Provinces, 1 inch to 20 miles, 1898.—District Narsinghpur, Central Provinces, 1 inch to 8 miles, 1898.—District Bálaghát, Central Provinces, 1 inch to 12 miles, 1898.—District Hoshangabad, Central Provinces, 1 inch to 12 miles, 1898.—District Nágpur, Central Provinces, 1 inch to 8 miles, 1898.—District Bogra, Lower Provinces, Bengal, 1 inch to 4 miles, 1897.—District Simla, with adjoining Native States, 1 inch to 4 miles, 1898.—Bombay Topographical Survey. Triangulation Charts for sheets 209 and 210, Season 1892-93; 243, 244, 275, and 276, Seasons 1884–90 (2 charts on

1 sheet), 1898. Charts of Triangulation, 1 inch to 2 miles. Sheets: Nos. 1, 5, 6, 7, Seasons 1891–94.—Calcutta and surrounding country, 1 inch to a mile, 1898. 3rd edition, 3 sheets and pamphlet. Index to the Standard Sheets of Bengal, 1898.—Map of Persia in 6 sheets, 1 inch to 16 miles, 1898. *Presented by H.M. Secretary of State for India through the India Office.*

Philippine Islands. **U.S. War Department.**

Province of Cavite. Scale 1 : 135,000 or 2·1 stat. miles to an inch. War Department, Adjutant-General's Office, Military Information Division. Washington, D.C., 1898.

Shantung. **Gaederts.**

Wegeaufnahmen in der Provinz Schan-Tung, als Vorarbeit für die geplante Eisenbahn von Tsing-Tau über Tsinau-Fu nach Té-Tschou ausgeführt und gezeichnet von Ober-Ingenieur A. Gaedertz, 1898. Scale 1 : 500,000 or 7·9 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1899, Tafel 5. Gotha: Justus Perthes, 1899. *Presented by the Publisher.*

AFRICA.

Africa. **Service Géographique de l'Armée, Paris.**

Carte de l'Afrique. Scale 1 : 2,000,000 or 31·1 stat. miles to an inch. Sheet 14, Assouan. Service Géographique de l'Armée, Paris. *Price 1 fr.*

Africa. **Prompt.**

Carte de la Vallée du Nil du Lac Tchad et du Bassin du Congo. Scale 1 : 6,000,000 or 94·7 stat. miles to an inch. Dressée par M. Prompt, Inspecteur général des Ponts-et-Chaussées en retraite. Maison Andriveau-Goujon (Henry Barrère), Paris, 1898. *Presented by the Publisher.*

This is a roughly produced map containing several serious errors in the manner in which the boundaries are laid down.

AMERICA.

Central America. **Sapper.**

1. Originalkarte des nördlichen Mittelamerika. Nach eigenen Aufnahmen und allen vorhandenen Quellen entworfen und gezeichnet von Dr. Carl Sapper. Scale 1 : 1,100,000 or 17·3 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Ergänzungsheft No. 127, Tafel i.
2. Geologische Karte des nördlichen Mittelamerika von Dr. Carl Sapper. Scale 1 : 1,100,000 or 17·3 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Ergänzungsheft No. 127, Tafel ii.
3. Skizze einer Bodenkarte des nördlichen Mittelamerika von Dr. Carl Sapper, 1897. Scale 1 : 3,000,000 or 47·3 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Ergänzungsheft No. 127, Tafel iii.
4. Geologische Profile durch Yucatan, Chiapas, Tabasco, Guatemala, etc. Entworfen und gezeichnet von Dr. Carl Sapper. *Petermanns Geographische Meitteilungen*, Ergänzungsheft No. 127, Taf. iv. und v. Gotha: Justus Perthes, 1899. *Presented by the Publisher.*

Cuba. **U.S. War Department.**

Military Map of the Island of Cuba. Prepared in the War Department, Adjutant-General's Office, Military Information Division. Washington, D.C., 1898. Scale 1 : 250,000 or 3·9 stat. miles to an inch. 8 sheets.
Havana Province, Cuba. Scale 1 : 105,600 or 1·6 stat. mile to an inch. Adjutant-General's Office, Military Information Division. Washington, D.C., 1898.

These maps have been prepared for the use of the United States officers in the late Cuba campaign. They have been compiled from the latest official sources, giving the boundaries of provinces, judicial districts, and municipalities. The importance of towns is indicated by the symbols employed to mark their position; railways, roads, and paths are laid down, and all telegraph stations are shown.

Haiti. **Tippenhauer.**

Geologische Karte eines Teiles von Südwest-Haiti. Scale 1 : 200,000 or 3·2 stat. miles to an inch. Von L. Gentil Tippenhauer, 1898. *Petermanns Geographische Mitteilungen.* Jahrgang 1899, Tafel 3. Gotha: Justus Perthes, 1899. *Presented by the Publisher.*

AUSTRALIA.

Western Australia. **Maitland.**

Geological Map of the Collie Coal Field, Scale 1 : 31,680 or 0·5 stat. mile to an inch. A. Gibb Maitland, Government Geologist, 1898. Geological Survey of Western Australia. *Presented by the Author.*

GENERAL.

World. **Meyer.**

Meyer's Hand-Atlas. Zweite, neubearbeitete und vermehrte Auflage mit 112 Kartenblättern, 9 Textbeilagen und Register aller auf den Karten verzeichneten Namen. I. Lieferung. Leipzig und Wien. Verlag des Bibliographischen Instituts, 1899. *Price* 30 *pf.*

This is the first part of the second edition of Meyer's Hand-Atlas, which, when complete, will contain 112 principal maps, and a full index of all the names which appear. It is designed for handy reference, and a special feature will be the plans of the principal cities of the world, which will be produced on a comparatively large scale. Twelve new maps will be added, and the others will be corrected and brought up to date. It is to be completed in thirty-eight parts, and the total price will be 11*s.* 6*d.*

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty**

Charts and Plans published by the Hydrographic Department, Admiralty, January and February, 1899. *Presented by the Hydrographic Department, Admiralty.*

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3013 m	= 1·4	Norway :—The Naze to Songvaar fiord, including the approaches to Svinör and Mandal. 2*s.* 6*d.*
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2350 m	= 0·5	Australia, east coast :—Double point to Cape Grafton. Plan, Cairns harbour. 2*s.* 6*d.*
2117		Keil bay :—Plan added, Als sound.
2366		Germany, north coast. Arkona to Dievenow river :—Plan added Sassnitz harbour.
2146		France, north coast :—Plan added, Villers to Le Havre, including the entrance to the Seine.
1869		Canary islands, Gran Canaria :—Plan added, Maspalomas anchorage.
919		Anchorages in the gulf of Aden :—Plan added, Bulhar anchorage.
1348		Natuna islands :—Plan added, Salat Lampa.
2718		Anchorages on the east coast of the Celebes :—Plan added, Kiertong road, Limba bay, Dolupi road.
1342		Cochin China :—Plan added, entrance to the Tourane river.
134		New Hebrides :—Plan added, Anuda or Cherry island.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.	Cancelled by	No.
2260 Plans of Manne fiord, and entrances to Svinör on this sheet.	New chart. The Naze to Songvaar fiord	3012
2333 Plan of Port Ekaterininskoi or Catherine on this chart.		
2680 Entrance of the Seine.	Plan added. Villers to Le Havre on this sheet . .	2146

No.	Cancelled by	No
1285 Plan of Ferrol bay on this chart.	New plan.	
1294 Plan of bay of Santa on this sheet.	Ferrol and Coisco bays	2332
1012 Gulf of Aden.	New chart.	
	Arabian sea	1012
253B Jebel Jan to Seyára eastern sheet.		
2618 Kelung harbour.	New plan.	
	Kelung harbour	2618
2350 Double point to Cape Tribulation.	New chart.	
	Double point to Cape Grafton	2350

Charts that have received Important Corrections.

A–P. Index charts. 1188, The World:—Coal and telegraph chart. 1698, England, south coast:—Dover bay. 34, the Scilly isles. 1406, North sea:—Dover and Calais to Orfordness and Scheveningen. 2333, Lapland:—Varanger fiord to Oleni Nyemetzki island. 2138, Baltic:—Approaches to the Gron sound. 213, Baltic:—Entrance to Gron sound. 2205, Black sea:—Kertch strait. 2058, North Atlantic:—Route chart. 1354A, Falkland islands. 278, North Polar chart, Pacific side. 797, River St. Lawrence:—Quebec to Kingston. 2860, United States, east coast:—Savannah river to St. Helena sound. 483A, West Indies:—Trinidad island and gulf of Paria. 481, West Indies:—Serpents mouth. 1285, Peru:—Begueta bay to river Chicama. 1357, Africa, west coast:—River Benin to river Cameroon. 1361, Africa, west coast:—Fernando Po to Cape Lopez. 653, Africa, east coast:—Ports of Conducia, Mozambique, and Mokambo. 66A, Maldive islands. 66B, Maldive islands. 941B, Eastern Archipelago, western portion. 2195, Anchorages in the eastern part of Celebes. 2577, Philippine islands:—Between St. Bernardino and Mindoro straits. 1269, Cochin China:—Saigon or Don-nai river. 1602, China:—Approaches to the Yang-tse kiang. 1316, Korea:—Cape Duroch to Linden point. 475, north-west coast of Australia. 1700, Australia, west coast:—Gage roads. 363, Australia, east coast:—Keppel bay and islands. 2532, New Zealand:—Ninety miles beach to Otago. X. 11, Signs and abbreviations adopted in Admiralty charts.

(*J. D. Potter, Agent.*)

United States Charts. **U.S. Hydrographic Office.**

Pilot Charts of the North Atlantic Ocean for March and April, 1899, and North Pacific Ocean for April, 1899. Published at the Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Rocky Mountains. **Wilcox.**

Six Photographs of the Upper Saskatchewan River Region, Canadian Rocky mountains, by W. D. Wilcox, Esq. *Presented by W. D. Wilcox, Esq.*

This series of photographs, of which the following is a list, consists of views taken on the eastern slopes of the Canadian Rocky mountains:—

(1) Source of the Little Fork of the Saskatchewan; (2) Swamp in Little Fish valley; (3) Camp scene in cañon of North Fork; (4) Fall near source of North Fork; (5) Mount Forbes from about 9000 feet; (6) Winter scene in pass between Blaeberry and Kicking Horse river.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

24 23 22

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F J Ö R D R

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Drangajökull

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24 23 22 21

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FLOI

HUSAVIK

Akureyri

Hofsós

Siglufjördur

Hvitaförd

Hraungerdi

Skeid

Holar

Hjaltabakki

Tindstadir

Undirfell

Grimstungur

Vatnsdalsfjöll

Vesturhópsvatn

Hindisvatn

Midfjardarvatn

Armarvatn

Ljosavatn

Myvatn

Laxá

Jökulsá

Fnjóská

Skjálfandafljót

Eyjafjardará

Hörgá

Svartá

Blanda

Vatnsdalsá

Vesturdalsá

Hjaltadalsá

Hjeradsvötn

Hjeradsvatn

Hjeradsflói

Midfjördur

Eyjafjördur

Skagafjördur

Höfdakaupstadur

Sauthárkrókur

Akureyri

Grenjadarstadir

Adaldalur

Reykjahlid

Reykjadalur

Fnjóskadalur

Bardardalur

Svartárdalur

Blöndudalur

Vatnsdalur

Langidalur

Hjaltadalur

Sléttuhlid

Fljót

Sudur-Thing

Nordur-Thing

Sudur-Sysla

Nordur-Sysla

Vestur-Sysla

Austur-Sysla

Rangar Valla Sysla

Arnes Sysla

Skaptafells Sysla

Hunavatns Sysla

Skagafjardar Sysla

Eyjafjardar Sysla

Thingeyjar Sysla

Midfjardar Sysla

Vatna Kl

Lang Jökull

Hofs Jökull 3610

Lit Arnarfell

Arnarfell 3250

Hlafells Jökull

Eyjafjallajökull

Godalands Jökull

Myrdals Jökull 3892

Torfa Jökull

Tindfjalla Jökull

Skaptá Jökull

Hagöngur

Hrafntinnusker

Kerlingarfjöll

Hlafell

Bjarnarey

Heimaey

Kalfstadir

Dyrhólaey

Thjórsá

Markarfljót

Skaptá

Hvitá

Ölfusá

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18 17 16 15

Grimsey

AXARFJÖRDR

SKJALFANDI

THISTILFJÖRDR

HUSAVIK

Kaldakvisl

Kaldalvisl

Aakeidi

THINGEYJAR SÝSLA

NORÐR

SUÐR

Dyngjufjöll

Aaskja

Kollotta Dyngja 3985

Dyngju Jökull

Bruar Jökull

VATNA JÖKULL

6425

KLOFA

Skaptá

Jökull

Hagöngur

Breidamerkr Jökull

Kristins Jökull

Hvannadalshnúkr

Öræfajökull

Skeidará

Skeidarársandr

Skeidarárjökull

Skeidará

Skeidará

Skeidará

15 13

Arctic Circle

66

65

64

ICELAND

To illustrate the paper by
Dr TH. THORODDSON.

coastline has been taken from the Admiralty Charts.
interior is based on B. Gunnlaugson's Survey, with
itions by Dr Th. Thoroddson.

Scale of Miles.

5 10 20 40 60

Natural Scale 1: 1,000,000 or 15·78 = 1 inch.

Church ..... + Principal Church & Seat of Justice 3
..... 1 Minor do. do. 2
Justice ..... ▪ Lava fields .....
Heights in feet.

15 14 13

P. S. Waller, F.R.G.S., del.